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GIFTS TO EDUCATION.

That Mrs. Stanford would some day add to the endowment of the Stanford University in California was understood, but it comes as a surprise to see her quietly turning over $30,000,000 to the authorities there in a single day. This great benefaction is, however, accompanied by another announced at the same time, Mr. Carnegie's gift of $10,000,000 for a National University at Washington. The generosity that can range from a grant in aid of the new library of the American Institute of Electrical Engineers up to this contribution to the cause of education on so colossal a scale compels unbounded admiration, especially when it is directed with care and wisdom to specific results. It is stated that Mr. Carnegie's offer to President Roosevelt does not involve the establishment of university buildings in Washington, but rather the placing in the hands of Government trustees of a fund from which the expenses of deserving students in the line of original investigation may be paid at home or abroad.

It is indeed along the lines of original investigation that money can be best spent, for while we would be slow to say that education is overdone, it does seem as though there were getting to be too many educational establishments, whereas laboratories are all too few. If some of the seats of learning already existing were consolidated, men like Rowland, Pupin, Trowbridge and others could be relieved of much of their teaching work and encouraged to prosecute the original research in which they prove themselves so competent. Indeed, such an endowment might well go to men not in educational work and institutions—we mean such inventors and investigators as Brush, Thomson, Tesla and Edison, though these fortunately have been able to profit sufficiently by their inventions to provide themselves with the means and appliances for further probing into the secrets of nature.

WIRELESS TELEGRAPHY.

Recent announcements have appeared in the daily press from St. Johns, Newfoundland, to the effect that signals have been received by Mr. Marconi there from Cornwall, England. Details of this very interesting and important event appear elsewhere in our current pages. The distance between these positions is in the neighborhood of 1830 nautical miles, or 2100 statute miles. The details reported up to the present time are altogether too meagre to enable any reliable conclusions to be drawn as to this alleged transmission across the Atlantic Ocean. It would seem that only triple successions of dots corresponding to the letter S in the Morse alphabet have been reproduced at the receiving instrument. In view of the well-known possibilities of disturbance from purely local atmospheric phenomena, it is only reasonable to look for the actual exclusive transmission of words by wireless transatlantic signaling before reliance can be fully placed on all the statements thus far made.

The maximum distance over which readable wireless signals have been hitherto transmitted seems to have been between St. Catharines, on the Isle of Wight, and the Lizard, Cornwall, a distance of 186 miles. The sudden increase in distance to 2100 miles represents more than a ten-fold increase of radius, which we should expect to be overstepped more gradually. Sooner or later, however, it is reasonable to expect that wireless messages will be transmitted over transatlantic distances. As to whether such distances can be bridged by Hertzian waves in a sufficiently definite and reliable way to enable

commercial messages to be exchanged is a much more difficult question to answer. If such signaling could be carried on in a positive manner, the question might next arise as to how far the wireless system would depreciate the value of the large amount of capital now lying at the bottom of the seas in the form of ocean telegraph cables. All that can be said at the present time is that enormous improvements have yet to be made, both in the range and in the selectivity of of wireless signaling before the Atlantic cables can suffer by wireless competition. The mere increase in range or effective radius of signaling is useless for this purpose, unless accompanied by a corresponding increase in the selectiveness of the signals, since to introduce a receiving instrument which shall be capable of responding to impulses within 2000 miles, instead of 100, merely means that a correspondingly greater field exists for other transmitting stations to interfere with its reception, unless the selective tuning of the receiver has been correspondingly improved.

But whatever may be the future as regards ocean cable telegraphy, there can be no doubt that short lengths of ocean can be, and, in fact, already have been, bridged by wireless telegraphy to the exclusion of cables, and that with even existing methods, the advantages of wireless telegraphs in the future to sailors and to shipping, must be enormous. Although our Navy is still ponderously investigating wireless telegraphy, sufficient light has appeared to British naval authorities to seemingly justify the serious adoption of the system, about 50 vessels of the British Navy having been already equipped with wireless telegraph apparatus. The system appears to be in the course of rapid adoption in the mercantile marine, and a number of wireless stations for communication with vessels at sea have been installed on the coast of England, besides at Gibraltar, Malta and various European ports. At this rate it will not be long before all important stations along the routes of trade will be equipped with Hertzian signaling apparatus.

If signals have actually, as Mr. Marconi intimates, thus been sent across the Atlantic, it is reasonably certain that an increase in power in the sending apparatus can ensure their being sent regularly. We expressed long ago the opinion that most experiments in wireless telegraphy labored under the disadvantage of inadequate input of energy. But if signals can be so sent we are inclined to think that the ordinary conception of the mechanism of transmission must be materially modified. Of course, the whole theory of the matter is in a tentative condition, but such a result should shake it up not a little, and lead to some very interesting developments. To return again to the commercial possibilities opened by wireless telegraphy across the Atlantic, it must be remembered that while a great deal has been heard about tuning the sending and receiving apparatus, very little seems really to have been accomplished, although some of Slaby's results look promising. Even if tuning can be carried out successfully on a small scale, it is by no means certain that equal success would attend it when large amounts of energy were involved. We are unpleasantly familiar with harmonic complications even in ordinary apparatus and the reduction of the impulses used in wireless telegraphy to an uncomplicated form is a rather formidable problem.

To look at another aspect of the matter, what would be the effect on wireless telegraphy in France and Germany of transmitters pounding away on the ether in hurling messages at America? What would the hypersensitive German Government say if the staff messages during its sacred army manœuvres were broken in upon by John Bull vociferously ordering pork in Chicago? The idea certainly involves the possibility of international complications of a highly interesting sort. Meanwhile, even the short-range land work is not having an altogether easy time of it. We have not heard that the portable sets sent to South Africa have materially helped in locating the elusive DeWet. The best results yet attained have been reached in communication with incoming steamers, and during naval manœuvres. The whole matter is obviously in an early stage of its development, and one must not expect too much at first. But the commercial possibilities are even vaguer than the scientific ones, and he would be rash who would hazard a guess at their magnitude. Meantime, Mr. Marconi is entitled to very warm and hearty congratulations on his great achievement, for the confirmation of which in various ways all now await with profound interest.

Zossen and Other Traction Matters.

A little more of detail has come to light regarding the recent experiments on the Berlin-Zossen line. As usual, the reports in the daily press—with no blame to them, however—proved to be somewhat inexact as well as incoherent, but the truth is sufficiently interesting and encouraging. It now appears that the maximum speed attained was almost exactly 100 miles per hour, the initial runs having been gradually worked up toward this point, after the cars had preliminarily been pulled rapidly over the line by a locomotive to make sure that the running gear was in first-class operative shape. The speed finally attained, while it has several times been surpassed in this country by locomotives, was great enough to give the motor cars a thorough test, and so far as present information goes, they behaved in an eminently satisfactory manner. The current collectors, motors, controlling apparatus and brakes seemed up to their work, and were evidently capable of developing a far higher speed than was actually attained. The limiting factor proved to be the roadbed, and the trials have been temporarily suspended pending its being put in proper condition for increased speeds.

This state of affairs is substantially what we predicted in speaking editorially of the Zossen work some time before the experiments began. There has not of late years been any serious reason to doubt the ability of electric motors to carry the running speed of cars above a hundred miles per hour, nor has the task of current collection at such speeds seemed forbidding, provided that the voltage of the working conductors were carried high enough to keep the volume of current within reasonable bounds. The controlling mechanism for the motors employed for this work must be a little unusual, but should not frighten competent engineers like those engaged, and likely to be engaged, on this important work. The track, however, is quite another matter, and to say that it is the whole battle would come pretty near the truth. In dealing with the high speed problem, electrical engineers have been far too prone to forget about the track, or, mindful of it, to pin their faith to lightening the motor car enough to counteract defects beneath it. Now, no possible lightening of the cars can make a bad track into a good one or a safe track out of a dangerous one. The Chicago-St. Louis high-speed road projected a decade since could have been pulled through to success so far as motive power went with the means even then at hand, but the track laid as planned with 70-lb. rails would have almost infallibly lead to disaster.

The roadbed for this sort of work must be exceptionally smooth and well ballasted, the curves and grades easy and the rails the stiffest that skill can design. Probably 90 lbs. per yard would suffice if the material were put where it would do the most good, but even with all these precautions the line should be pounded into shape at moderate speeds through at least one season before it is sufficiently solid for the purpose intended. When the Berlin-Zossen track is worked into shape, the rest will be comparatively easy, but we would earnestly advise the persistent use of a testing car, if such a thing is

available on the Imperial German Railways. To the best of our recollection, however, they are longer on red tape than on speed over there, and it would probably be simpler and quicker to import an American car for this purpose.

From this important work, we turn to note with pleasure some on this side of the water, of equal interest and encouragement to the electrical engineering community. Full account is given in our columns of the new plans for bringing the Pennsylvania Railroad and the Long Island into the heart of New York City by tunnels under the rivers, the trains all to be hauled by electricity. In view of what is being done on the elevated, and the plans of the New York Central, it is evident that so far as Manhattan Island is concerned, the electric locomotive and the electric car will soon reign supreme. With high-speed electric traction, a la Zossen, for the open country, and low-speed for the terminals, it would look as though the steam regime, magnificent and laudable as it has been, approximates to a definite consummation.

DISTRIBUTION AND METER LOSSES.

Those who point to the low cost of generating electrical energy in large central stations and use it for a text from which to preach a sermon on municipal ownership and the enormous profits being realized by all private companies would do well, if only on the grounds of fairness, to look into the matter of distribution losses, the *bete noir* of the central station man, who labors incessantly to reduce these losses. For the difference between the current generated and current sold is so great as sometimes to be startling even to those familiar with the subject.

For example, in an Edison direct-current three-wire network, fed direct from the power house, with which we happen to be familiar, and whcih represents fair average practice in that class of central station distribution, only 68 per cent of the energy metered at the central station switchboard is accounted for by the customer's meters. In other words, the central station is paid for only 68 per cent of the energy generated. The loss in the feeders and mains is considered by the manager of the station in question to be 15 per cent, leaving 17 per cent to be charged to consumers' meters running slow and failing to register the total amount of energy passing through them. The percentage of loss by slow consumers' meters is probably less in the plant referred to than in the majority of central station distributing systems, because there special attention has been given to meters. In another plant where the distribution is all by alternating currents at 2000 volts, supplying 100-volt secondary networks through transformers, the consumers' meters register only 60 per cent of the energy generated. In this case the loss in lines and transformers is probably not over 15 per cent, so that 25 per cent is chargeable to slow consumers' meters. As said before, these cases are by no means exceptions unless, perhaps, that they represent better than average conditions. These facts, however well known to the few central station men that follow them up and determine them, are but little talked of, and might well be given greater general publicity than they have been to counteract false ideas as to the delivery cost of electrical energy supplied on the consumer's premises.

From an engineering standpoint the main question is how to reduce distribution and meter losses. The mere question of loss in feeders and other lines is dependent either on considerations of good regulation or on how large an investment in copper it will be profitable to pay interest on. The matter of meter loss, however, is dependent on management, testing and inspection, and is one which by no means is as thoroughly thrashed out by central station men as it should be. It may be argued that the loss of revenue through consumers' meters failing to register all the energy passing is equivalent to a discount equal to the amount of such loss, and when considered as such by the company is of no financial detriment. If the loss by slow meters were distributed pro rata among the customers according to the amounts they used, or deducted from the meter readings of the class of consumers using the largest amount of current in proportion to the maximum, it would be all right to consider the loss by slow meters as a discount from the regular schedule. But meters are not accommodating enough to work that way in practice. The very classes to which they give the most liberal discounts are the ones which it costs the central station the most to supply, namely, residences which have a large number of lights and consequently a large meter installed, but which usually burn but few lights. The large meter with few lights on is very apt to run slow. If nearly the full number of lights are on there is not the same likelihood that the meter will run slow then as when it is lightly loaded. Then, too, meters are not accommodating enough to run slow at the same rates, and injustice and dissatisfaction result. Customers must have confidence in the accuracy of the meters if the service is to be made satisfactory to them. The discount argument will not hold in defence of allowing meters to get into bad condition.

How to keep meters in better condition is a matter to which much attention has been given in the past by a few of the more progressive central stations, but to which matter the majority are only recently directing serious thought. Practice is at present divided between two general methods. One is to test meters or check their accuracy from time to time in place on the consumer's premises, without removing or altering them in any way from their actual working conditions. The other plan is to do all meter testing in the shop and take a meter down whenever it is to be tested, substituting in its place a newly tested meter. Former practice checked or tested meters only on complaint of the customer or suspicion by the company. Modern practice is to check meters at regular intervals of from two years to six months—the latter interval becoming the more common. There is more chance to overhaul and test a meter thoroughly in the shop than on the consumer's premises, but the advocates of the other method point to the fact that a meter tested in the shop may be altered by the treatment it receives before it is put up; and, furthermore, that in view of the slight attention usually necessary to put a meter right, the expense and trouble of removing the meter to the shop is not justified. Indeed, the usual operations that must be gone through with to correct a meter (cleaning the commutator, renewing the jewel or adjusting the drag magnets) can be done in less time than it would take to replace and remove the meter alone.

Where meters are tested *in situ*, practice is again divided as to the method of checking, some sending two men with a stop-watch and standard indicating wattmeter, others keeping on hand in the testing laboratory an assortment of carefully calibrated recording wattmeters of all sizes and sending these out with one meter inspector who simply compares the revolutions of each consumer's meter for a short time at different loads, with that of a standard recording meter of the same size temporarily connected in the same circuit; a place being provided to hang the test meter below the regular consumer's meter. It is thus seen that there are plenty of methods to choose from, any of which is good if conscientiously carried out by good men, but any of which may be marred by carelessness.

Manhattan and Electric Traction.

The work of preparing the Manhattan Elevated power plant has continued very actively during the present week, and an early operation of part of this system is looked for confidently. This being the case, inquiry naturally arises as to the benefit to the public and the company. By far the best analysis is that made by the *Street Railway Journal* in a recent issue as follows:

Probably the closest parallel in this country to the electrical equipment of Manhattan is afforded by the Lake Street and South Side Elevated roads in Chicago. Both of these lines are paralleled by surface roads, and the latter also by the unsurpassed steam suburban service of the Illinois Central. The percentage of operating expenses to gross on Lake Shore, while equipped with steam, varied between 67.67 per cent and 61.78 per cent, while with electricity it has been between 51 and 47 per cent. The percentage in 1899 and 1900 for South Side was 57.2 and 58.2, respectively, as against 65.5, 69.1 and 78.9 under steam in 1897 and the two preceding years. The Manhattan Company's percentage for the year ending Sept. 30, 1901, was only 50.97 per cent. The operating expenses of the company during the year ending June 30, 1900, are divided as follows:

Maintenance of way and structure	$421,628
Maintenance of equipment	583,376
Conducting transportation	3,877,123
General expenses	350,491
Total	$5,232,618

The motive power at present by steam costs $949,893, or 8.8 cents per train-mile, while electricity should not cost more than 7.2 cents, or a saving of 1.6 cents per train-mile. This would result in the saving of $171,843. The total saving, therefore, would be, assuming same mileage and speed:

Power	$171,800
Saving on firemen	330,000
Saving on motormen	110,000
Total saving per trains	$611,800

The same number of cars that in 1900 made 10,740,183 train-miles could, with electrical equipment, have made probably between 12,000,000 and 13,000,000 train-miles with but little additional cost for power and maintenance, and practically no additional cost for conducting transportation. If 13,000,000 train-mile could be made, figures for conducting transportation would be as follows, present train mileage being 10,740,183:

	Car Mileage.	Total Cost.	Car Mile Cost.
Steam 5-car train	44,878,000	$3,877,123	.086c.
Electric 5.18 cars	67,340,000	3,577,814	.053c.

A saving of .033 cent per car on a total of 67,340,000 car-miles does not seem unreasonable and would amount to $2,222,220, or more than enough to pay 3 per cent additional on the old capitalization of the company and 7 per cent on the later issue, putting the stock on a 7 per cent basis.

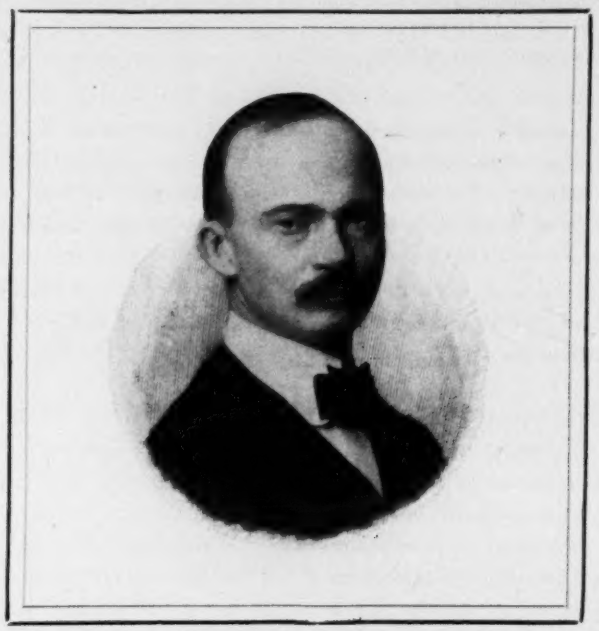
Electrical Engineers of the Day—XXV.

W. B. Potter.

Few engineers in the electrical profession have done more to advance the electric railway art to its present place than has William Bancroft Potter, the engineer of the railway department of the General Electric Company. Mr. Potter was born at Thomaston, Conn., in 1863, and received his first training in engineering in a large machine repair shop at Hartford. Here all classes of repair work was done on stationary engines, steamboats, steam fitting and mill work. The variety of work was of great assistance in giving an experience of value to Mr. Potter in mechanical and machine design.

During this period the Hartford Electric Light Company was started and commenced operations with a number of arc machines, which were among the first of their type. In connection with repairs on the engines of this plant, Mr. Potter became acquainted with the chief engineer, who advised him strongly to take up the new branch of engineering. Mr. Potter at first strongly objected to leaving his mechanical work, but finally in 1887 applied to the Thomson-Houston Company for a position, and was told to report at Lynn. His first duties were in connection with arc lighting apparatus, and after several weeks at the factory he was sent to Greensboro, N. C., starting the system of arc lighting in that place. He shortly afterward went to Raleigh, N. C., to overhaul the lighting plant there, which meant putting everything in order from the engines to the pole line, and although this was Mr. Potter's first large contract, he completed the work in such shape that he was retained by the company as superintendent until 1889. Being impressed with the possibilities in the electric railway field, he gave up this position and returned to the Thomson-Houston Company at Lynn, and applied for a position in the railway department. After a year's experience on railway construction work he entered the Lynn factory, first as engineering assistant to Mr. J. B. Cahoon and afterward to Mr. W. H. Knight, engineer of railway work.

The Thomson-Houston Company was experimenting about this time with its first magnetic blowout series parallel controllers, and the other applications of the magnetic blowout, such as circuit breakers, etc. In this work Mr. Potter's originality and ability to apply theory to successful practical operation was of great value, and the development of many of the railway devices which are to-day standard owe their origin and design to him. While interested in the power station side, Mr. Potter's attention was principally turned towards



railway equipments, and his practical mind saw at an early date the advantage of standardization for apparatus of this class.

Mr. Potter's attention was given largely up to the time of the consolidation with the Edison General Electric Company to the design and operation of railway motors, controllers and switchboards and the many smaller parts of a railway equipment. After the consolidation of the two companies to form the General Electric Company, Mr. Potter removed to Schenectady and was made engineer of the railway department of the entire company in 1895, which position he has held up to the present time.

In the past few years he has paid special attention to heavy and high-speed railway work, and has invented many devices used in this class of service, starting with the Intramural Railway at the Chicago Fair in 1893. The equipment of the Chicago elevated roads with electricity, and later the N. Y., N. H. & H. R. R. and Manhattan Elevated in New York have all been done under his personal supervision from the manufacturing company's standpoint. The tremendous development of interurban and suburban railways during the past few years has also received Mr. Potter's close attention, and his practical knowledge and skill as an inventor has been turned towards this branch of the art. Already alternating-current apparatus is becoming as standardized and as common as direct-current machinery was five years ago.

Mr. Potter has made several trips abroad in connection with great railway undertakings on the Continent and in England, notably the Paris-Orleans Railroad in France and the Central London Underground in England. His name appears from time to time among those to whom patents have been granted, and no less than 75 now stand in his name.

The Debt of Electrical Engineering to C. E. L. Brown—V.

BY B. A. BEHREND.

THE FRANKFORT STATION.

IN Fig. 21 is given a drawing of the Frankfort generators. They were designed in 1893 and put into operation in 1894. Before entering upon details of this machine we will shortly relate some of the conditions pertaining to the history of the Frankfort station. The City of Frankfort had long been considering the building of a large municipal station for the distribution of light and power over a wide area. The electrical exposition at Frankfort in 1891 was inaugurated with a view to giving the various German electrical manufacturers an opportunity for displaying their work. When it came to the working out of a proposition for the City of Frankfort, the German factories, not experienced in alternating-current work, advocated the use of direct current, while Mr. Brown, having just developed some very good single-phase motors, stood up energetically for a single-phase alternating-current plant. There was very little inclination among the members of the City Council to award the contract to the "foreigner," since when reason fails prejudice must step in; but Mr. W. H. Lindley, the city engineer, a man of great ability and talent, seeing the advantages connected with the alternating-current system and having unlimited confidence in the ability of Mr. Brown to carry out this large plant, and doubtless alive to the poorness of the designs of the German firms in alternating currents at that time, consistently advocated Brown's proposition. In Lindley's address to the City Council reviewing the various propositions, the following passage occurs: "In the place of a conglomeration of engineers whose ignorance must be acknowledged, we have before us one of the most talented engineers in the field of electrical engineering, whose constructions show the able hand of an ingenious designer." Mr. Lindley's words were very strong, but those who know intimately the state of affairs at that time, cannot refuse to admit their truth.

We will now turn our attention to the details of the 525-kw single-phase generators for Frankfort.

As is seen from Fig. 21, the generator is of the flywheel construction, which has been so successfully built by Mr. Brown for the past ten years. The rated output of each generator—there are four 525-kw and four 1050-kw generators in the station—is 3000 volts and 175 amperes at 85 revolutions and 45.3 cycles. Each generator has 64 poles, the bore of the armature being 550 cm., and its length 32 cm.

The field winding consists of 64 coils of 50 turns each. It is made of copper strip of 100 sq. mm. section, wound on edge, the resistance of the 64 coils in series being .44 ohm. The copper loss in the armature is only 1¼ per cent, while the exciting energy does not exceed 1.8 per cent.

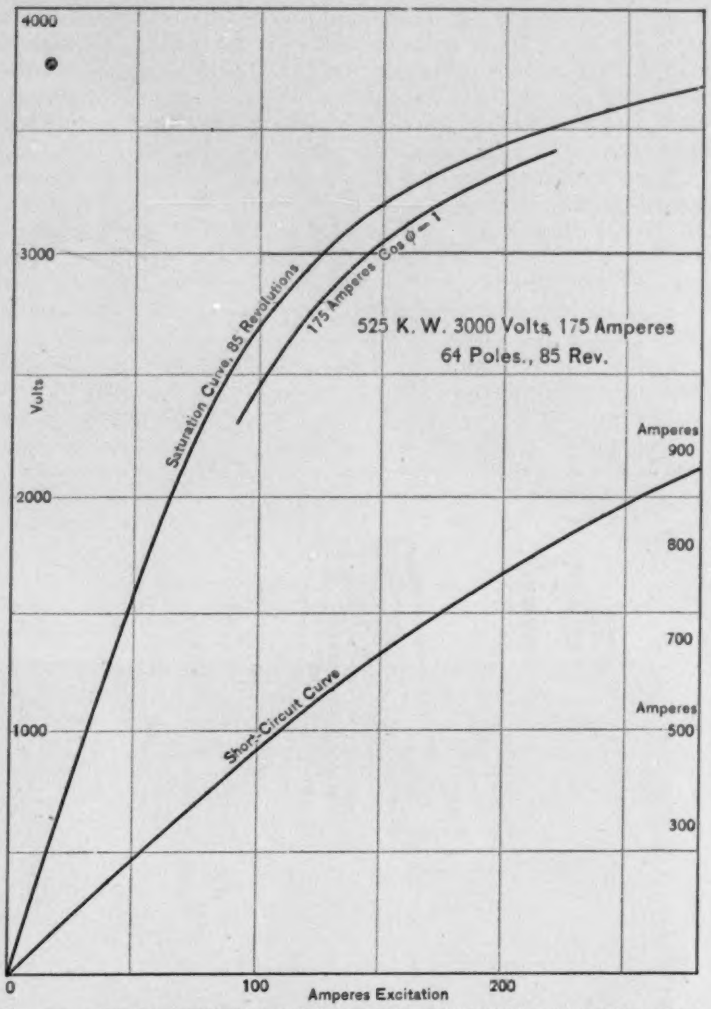


FIG. 22.—CHARACTERISTIC CURVES OF 750-HP FRANKFORT GENERATORS.

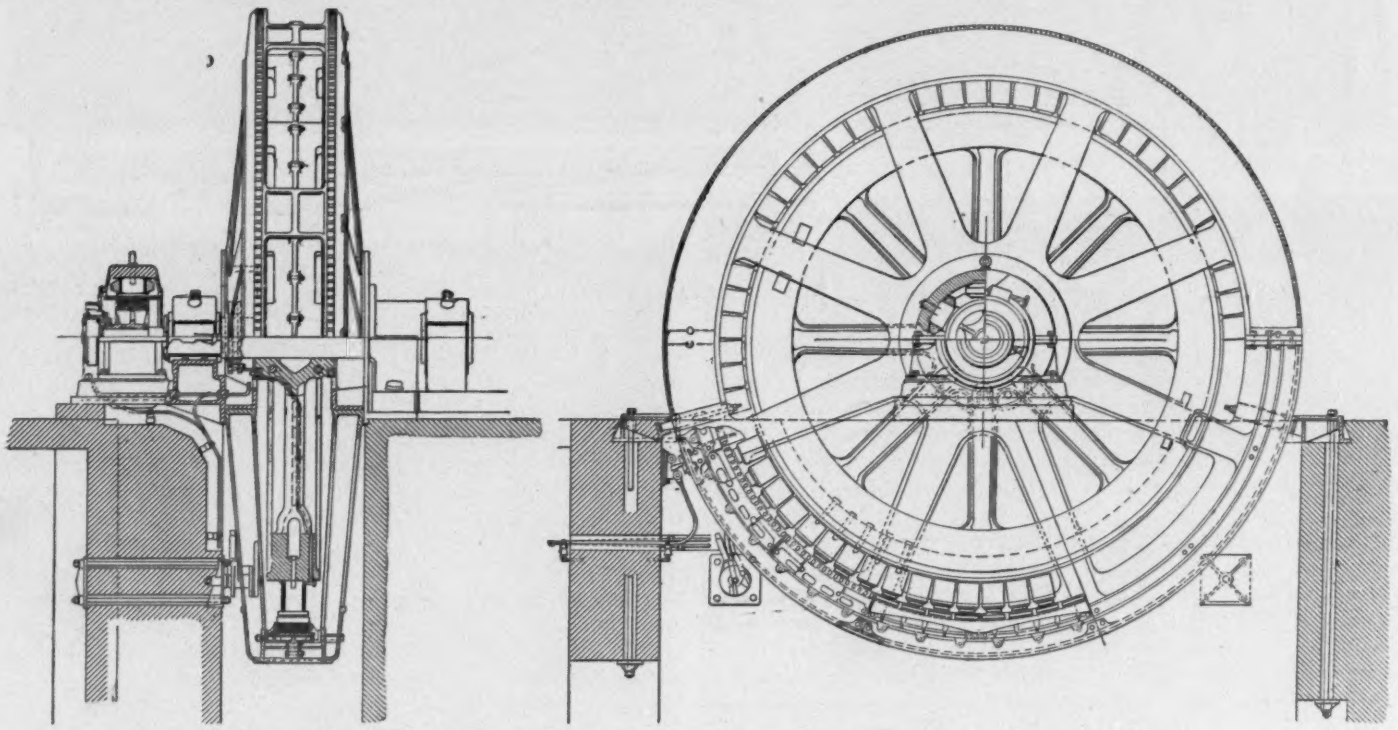


FIG. 21.—750-HP, SINGLE-PHASE FLYWHEEL GENERATOR. CITY OF FRANKFORT, GERMANY, 1894.

There are altogether 256 slots, of which 128 are empty. There are 64 coils of copper strip, each coil having 8 turns of 54 mm.² section. The resistance of the armature winding is .21 ohm.

From the characteristic curves given in Fig. 22, we see the good regulation of this machine, the short-circuit current at full excitation being almost four times as large as the normal current. The rise

in voltage, if the full current of 175 amperes is thrown off, is 180 volts on a non-inductive load, or 6 per cent.

The great advantage of the field coil made of strip on edge consists, besides being a very mechanical and almost indestructible construction, in the better radiation of such a coil, as the heat is conducted to the surface through the copper and as it has not, as in ordinary field coils, to pass through the poorly conducting insulation. Such field coils, therefore, take less space and heat less than ordinary field coils.

There are some interesting features of design that deserve some comment. The solid cylindrical steel poles are used by Mr. Brown wherever applicable, as they permit the use of round field coils which are easier to make and embrace the largest flux with the shortest perimeter. Only in a few instances Mr. Brown laminates the pole tips as, for instance, in his Paderno generators, which have rather large holes in the armature.

With the closed slot as shown in Fig. 21, the eddy currents in the pole pieces are negligible. The objection to the closed slot that no form-wound coils made outside of the machine can be used, does apply in this country where the price of labor is high, but it is of much less weight in Europe. The windings of all of Mr. Brown's machines are made very carefully and look strikingly neat and well-arranged. If a coil burns out, it is taken out and a new one is wound in by hand. The extremely careful workmanship of these hand-wound coils makes the occurrence of a breakdown much less frequent.

The armatures of the Frankfort generators are built up of 16 segments, each containing 4 coils. The segments can be taken out and repaired, as is clearly shown in the drawing. In these generators Mr. Brown also used for the first time the peculiarly rigid and stiff construction of end-housings which support the armature, center it in regard to the field, and permit of the armature being turned into any position for purposes of repair. Fig. 21 shows this construction clearly. In such large generators it is extremely difficult to make the frame rigid, and even if much weight is put into the frame, the latter is yet almost plastic, and it becomes a very wearisome process to adjust the air-gap all around the periphery. With comparatively little weight Mr. Brown obtains an amount of stiffness and rigidity that could never be obtained in the usual way, and his construction must be considered superior to the ordinary frame for very large diameters.

It may not be amiss to call the attention of designing engineers to the particulars of this machine. They will find that after almost ten years, its design need not shun comparison with any work done of late. The weight of the armature is about 57,000 lbs., the weight of the revolving field with flywheel being 60,000 lbs.

The larger units are represented in Fig. 23. They give 3000 volts and 435 amperes at 85 revolutions on a circuit of a power factor of 80 per ecnt. They are constructed like the smaller units, and their armatures weigh 150,000 lbs., the revolving field with flywheel weighing 100,000 lbs. In 1897, when they were built, they were as to size the largest machines then running, and they are only now surpassed in size by the 5000-kw Manhattan generators of the Westinghouse Company. The normal rating of the Frankfort generators would be 2000 kw at 85 revolutions and 45.3 cycles if they were wound for three-phase currents. Their outside diameter is 25½ ft., their bore being 22½ ft. A performance curve of these machines is given in Fig. 24. Fig. 25 shows a photographic reproduction.

Fig. 26 shows the Frankfort station with the small generators in front, and two of the large units in the back. They are driven by tandem engines, and a novel feature that has been greatly followed on the European Continent is that the cranks of the engines are synchronized so that variations in the angular velocity of the engines appear simultaneously in the same direction in all machines. The Frankfort station has been in successful operation since 1894, and it is one of the finest and simplest stations in Europe.

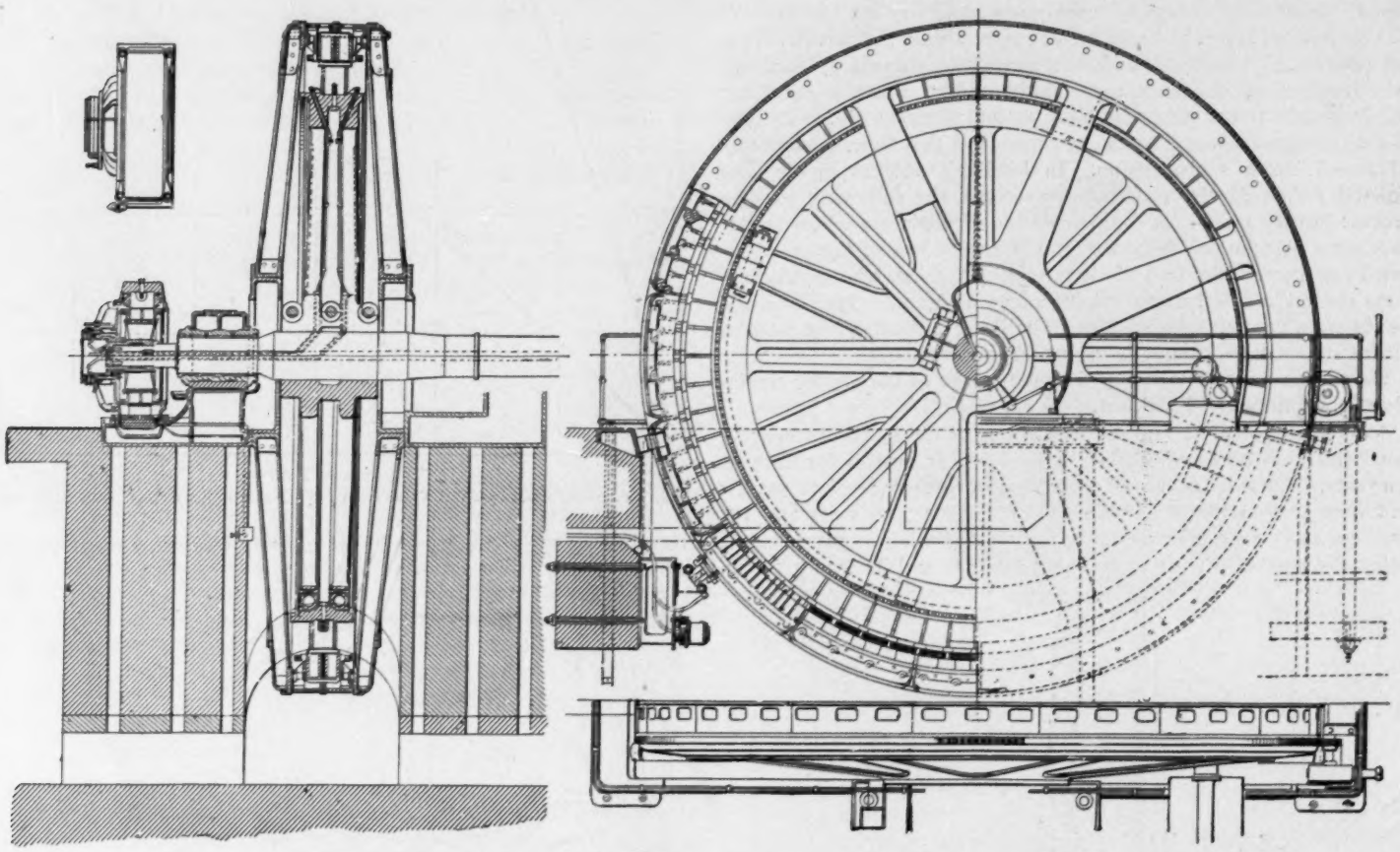


FIG. 23.—1500-HP SINGLE-PHASE GENERATORS, CITY OF FRANKFORT, GERMANY.

On the Frankfort mains there are running now single-phase induction motors whose output amounts to over 5000 hp. The testimonials of their owners are evidence that these motors are reliable in service and require little or next to no repair.

From the standpoint of the American designer it would be argued that Mr. Brown's Frankfort generators are very large, or even too large, in diameter. A good deal might be said for and against such a criticism. Aside from mechanical reasons there should be no doubt that the diameters are well chosen by their designer, for the weight of the active material is small, and so are the losses—the core loss, the loss in the armature copper and the energy for excitation. The latter is remarkably small in all of Mr. Brown's designs, owing to the use of cylindrical poles and to a careful choice of the number of ampere-turns on the armature per pole. It will thus be clear that electrically these machines must be considered excellent in all respects,

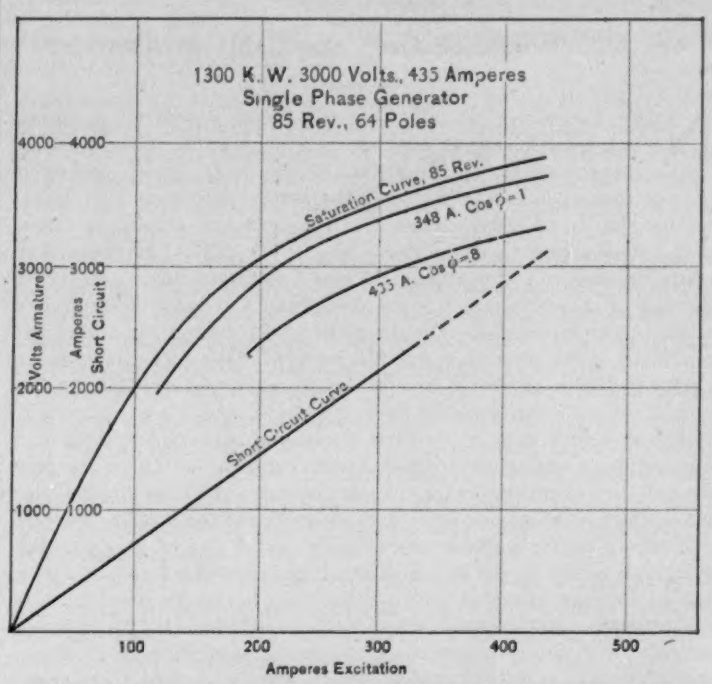


FIG. 24.—CHARACTERISTIC CURVES OF 1500-HP SINGLE-PHASE GENERATORS. CITY OF FRANKFORT.

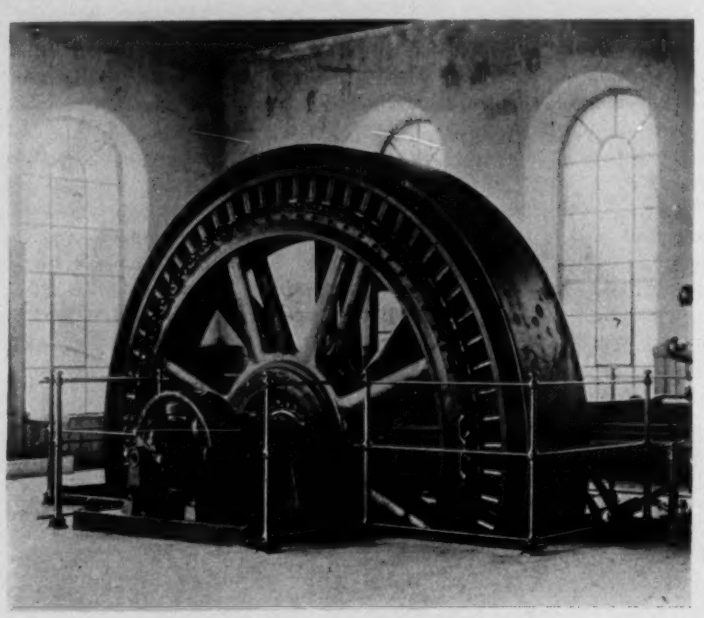


FIG. 28.—EXTERNAL FIELD FLYWHEEL GENERATOR.

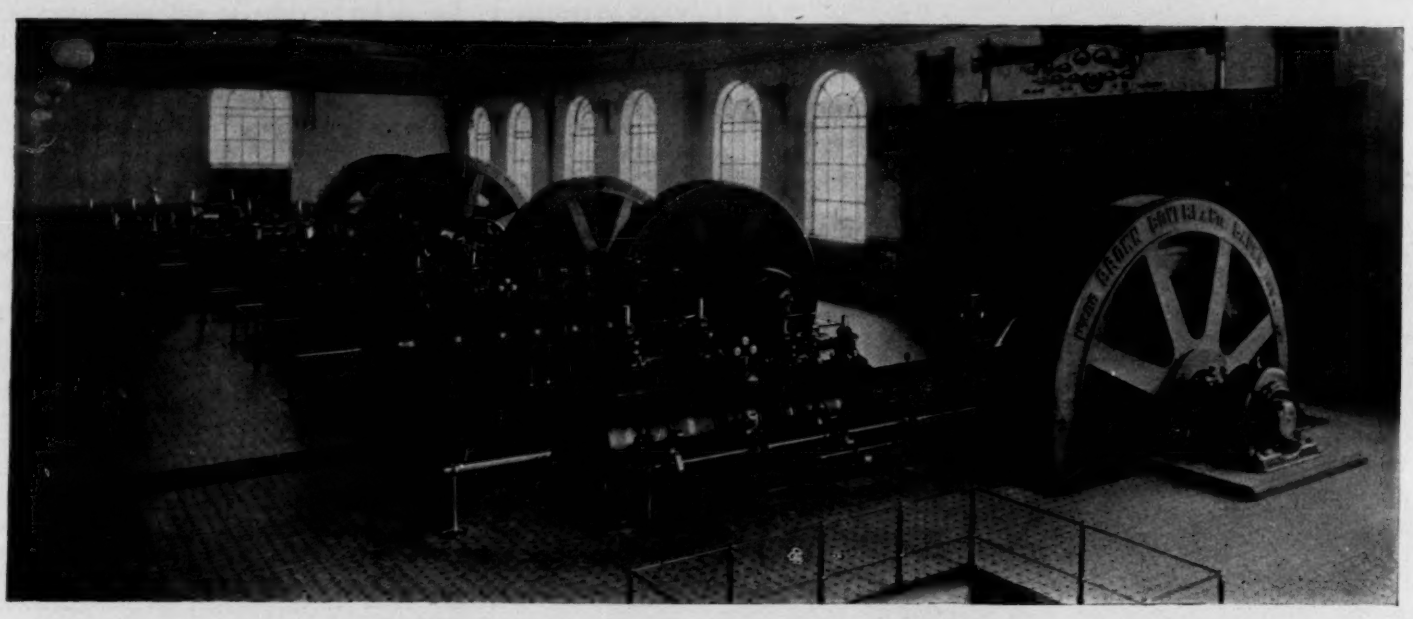


FIG. 26.—SINGLE-PHASE GENERATORS IN THE CITY OF FRANKFORT.

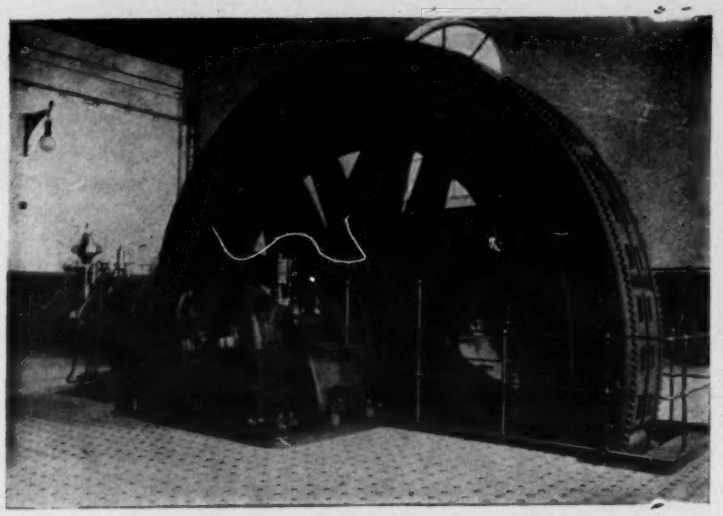


FIG. 25.—1500-HP SINGLE-PHASE FRANKFORT GENERATOR.

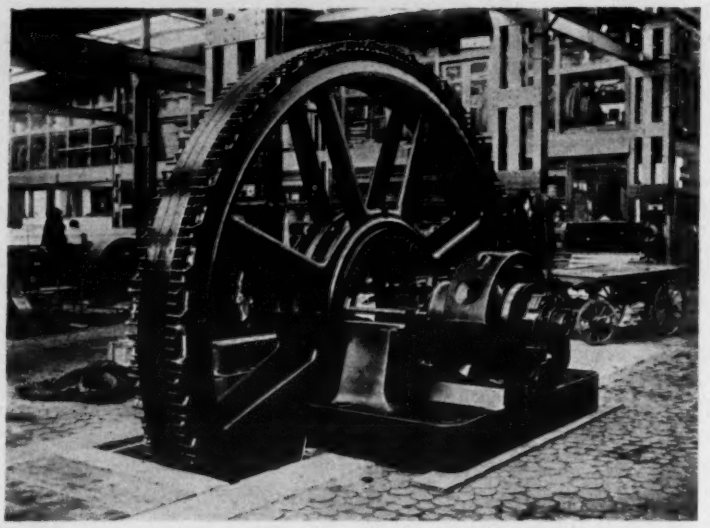


FIG. 29.—ARMATURE OF EXTERNAL FIELD FLYWHEEL GENERATOR.

SINGLE-PHASE GENERATORS IN THE FRANKFORT, GERMANY, STATION.

and the large diameter was decidedly a step in advance, especially considering the fact that such large diameters were at the time of the design of the Frankfort station entirely unheard of.

In short, the Frankfort generators presented a new departure. The large pole pitch diminished the leakage from pole to pole. The width of the pole was small in comparison with the pole pitch, while the armature was made wide, which construction increases the e. m. f. slightly. All objections to the large diameter thus fall to the ground excepting the greater difficulty of handling the large parts in the shop and of making the armature frame stiff enough not to collapse. In regard to the former objection, Mr. Brown knew difficulties only to overcome them, and in regard to the latter objection, Mr. Brown devised a construction, shown in Fig. 27, which permitted the easy entering of armature and field, and stiffened at the same time the armature frame.

There was an article in the papers not very long ago about the advantage of working an alternator slightly beyond the bend of the saturation curve in order to diminish the drop, and the author claimed novelty for his design. But almost ten years ago Mr. Brown had clearly grasped the idea and put it into practice, as is borne out by the saturation curves published in this memoir. It is a curious psychological fact that we seem to think that when an idea has at last been understood by us, that it has never before been understood by anybody else.

To make machines of small output as flywheel generators, Mr. Brown devised in 1894 the type illustrated in Figs. 28 and 29. The poles are bolted to the flywheel and project toward the shaft. The

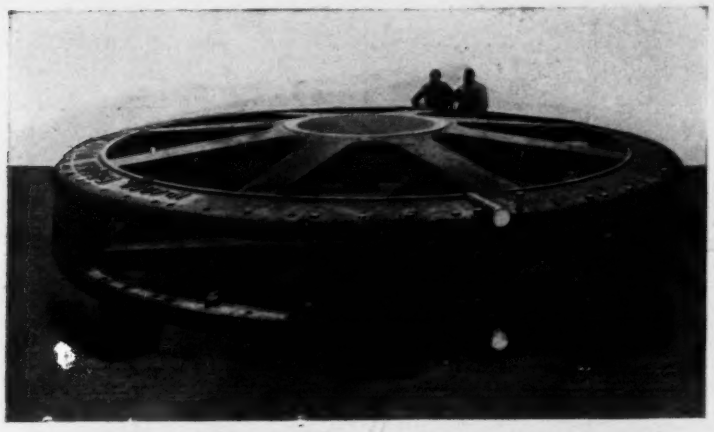


FIG. 27.—ARMATURE OF 1560-HP GENERATOR, CITY OF FRANKFORT.

armature is stationary and mounted on a bracket projecting from the bearing housing. The three-phase armature winding consists of round copper bars, as is clearly seen in the illustration. The construction of the armature mounted on the bearing housing leads of necessity to a perfect centering of armature and field. The core loss of the armature is diminished, as the volume of the latter is smaller than in the ordinary type for the same surface speed, and the moment of inertia of the flywheel is greatly increased. This type of machine, which they term at Baden the Cairo type, must be considered as a very happy combination for steam-driven generators of comparatively small output.

Arbitration Proceedings Favor Mr. Yerkes.

Note was made in these pages last week of the decision in Mr. C. T. Yerkes' favor, in connection with the arbitration proceedings relative to the London Underground. The report is also confirmed that Mr. Yerkes has awarded his contract for the London underground electrical generators and steam plant to the British Westinghouse Electric & Manufacturing Company, whose new works at Manchester, England, will be in operation within a few weeks. The electrical generators will be as large as those for the Manhattan Elevated Railway in New York. The Westinghouse generators at Niagara are 5000 hp each; their Manhattan machines are 6650 hp each, and those for Mr. Yerkes' London enterprise will be 6660 hp each, driven by turbine engines, by far the largest of their kind.

The work will begin immediately, and within two years from Jan. 1 the stifling old steam tunnels which penerate London in all directions, will be whitened and ventilated, and served by an up-to-date system of electric trains. So far as is known, no part of the motor contract has yet been given out.

The Manufacture of Deep Sea Cable in America.

NOW that Congress has assembled and President Roosevelt has insisted in his message to Congress upon the pressing importance of an American Pacific cable, great interest in the question of such a cable and in the further question of its manufacture in the United States, is being shown among electrical men. The action taken by the Commercial Cable Company is already familiar to our readers, and note has been made of the introduction of two bills into Congress affecting the work in connection with such an enterprise. But the main point, namely, the ability and readiness of the American manufacturer to make such cable, or the extent to which he should be afforded protection in establishing that branch of industry, has not been discussed, and we are now glad to submit a little data in regard to those vital matters, resulting from our inquiries among those most deeply concerned. There are features of the situation that are by no means clearly understood, but upon which light may be thrown to advantage at the present juncture.

Under paragraph 450, in the Dingley Tariff Act of July 24, 1897, telegraph cables would pay a duty of 35 per cent ad valorem in so far as they are imported into this country; but as an Atlantic cable, for example, 2500 knots in length, only has three miles of its length brought within our jurisdiction, the actual protection to American manufacturers is only 3-2500 of 35 per cent, or 1-25 of 1 per cent—practically nothing. If the Dingley tariff of 35 per cent could be made effective upon the whole length of such cables, the percentage would be satisfactory, though not excessive, as will appear from later statements. The contention is that it should be enforced until American manufacturers have firmly established themselves in that line of business, and until the American manufacturer can get his materials for cable manufacture at as low a price as the foreigner, and until, by improvements in machinery, etc., the difference in wages can be offset. It might require ten years, or it might not be more than five years—time alone can determine definitely.

It should be applied, it is contended, as a tax on imports, with the proviso that every foot of a foreign made cable landed on our shores shall be held, for purpose of assessing the tariff duty, as imported, because otherwise there is no protection to American manufacturers on such cables, and because, furthermore, that part of the cable within one marine league cannot be severed from the whole, and accomplish any useful commercial purpose. It might be so held, under the present tariff laws, but nothing short of a United States Supreme Court decision would settle the question, and, therefore, the tariff laws should be amended, if practicable, so as to leave no room for other interpretation. If that be not practicable, then a law should be passed absolutely prohibiting the landing of foreign made cables on on our shores, and lastly (but this is least desirable, and perhaps least likely to meet approval) a bonus or subsidy of 35 per cent might be authorized on submarine cables exceeding a certain length, say 100 miles, when installed.

Moreover, the extent to which capital must be risked in the development of a deep-sea cable industry has perhaps not yet been fully realized by those who have not looked into the subject. Some of our American cable manufacturers have of late removed from inland factories to establishments planted upon fairly deep tide water, but so far as we can ascertain none of them have yet felt warranted in making the heavy full investment that would be required until they can virtually be guaranteed that the contracts shall be placed on this side of the water. Otherwise, it would be foolish even to make a start. The amount of cable made in this country for rivers, lakes and even arms of the sea is enormous, but the deep sea work, with all that it involves, is quite another matter from the manufacturing point of view.

Let us look then into the cost of a deep sea cable factory. Twenty nautical miles per day is the minimum capacity that an American manufacturer should provide for. A large proportion of the machinery would have to be bought abroad in order that the plant might be put in operation at the earliest possible moment; or if built at home the designing of it, the making of the patterns, and the making of the machinery for a first plant, and a first-class plant, of this kind, would cost as much as the foreign price of such machinery, plus the American duty, which is 45 per cent, and then the package, freight and insurance will add approximately 10 per cent more, so that the American factory will cost approximately 55 per cent more than the foreign factory. Very extensive and substantial buildings

are necessary to house the machinery and conduct the manufacture, costly excavations and walls for the necessarily large number of steel cable tanks, and extensive real estate and docks near large centers of population and with deep-water frontage, must be provided. Altogether, it is estimated that such a plant will represent an investment of approximately $750,000.

The amount of working capital which an American company must provide in order to carry out a cable contract with a private company, or with the government, as is proposed, amounting to about $12,000,000 to $15,000,000, will depend upon the terms of payment that the buyer may be willing to adopt; but if the production and installation of the cable be spread over three years' time, giving $4,000,000 to $5,000,000 per annum, any manufacturer undertaking the contract would need to have a ready working capital of somewhere between $2,000,000 and $5,000,000, depending upon the frequency and the stages of manufacture at which the buyer would make partial payments. This is apart from the cost of the plant, and of the ship or ships.

So much for the investment in the plant and the working capital. The next point in order is that of labor, one that President Roosevelt has just insisted must be first in mind in all changes of the tariff and all efforts towards reciprocity. The data given below is based upon the best information that can be had from American and foreign manufacturers and workmen. The foreign submarine cable factories work two turns of 12 hours each, or one of from 12 to 14 hours, according to conditions. Laborers in England are paid 5 pence per hour (10 cents), while we pay $1.50 to $1.75 per 10-hour day. Skilled employes applying gutta percha to the wire get 7 to 8 pence per hour, while we pay for corresponding work (covering wire with rubber) from $2 to $2.50 per 10-hour day. Skilled employes running the closing machines (armoring) get 8½ pence per hour, while we pay $2.50 per 10-hour day. Machinists get 10 pence per hour, while we pay from $2.50 to $3.50 (the latter being specially skilled machinists) for a nine-hour day. It will be seen from the above that the American labor cost is from 50 to 75 per cent greater than the foreign cost for similar service. Add to this the fact that the government cable must be made upon the basis of an eight-hour day, and that under the circumstances the manufacturer will almost certainly have to pay the same for an eight-hour day as he now pays for ten hours, or else fail to get the necessary skilled hands for three shifts per day (the running of such a factory should be continuous), and it becomes apparent that the labor cost will be at least twice as great here as it is in foreign lands.

The next handicap to come up for consideration is that of the cost of materials, although here the facts, or the implications they carry, are rather more complex, and might perhaps be changed somewhat by the present confused status of copper, but in the main, what is stated below is true of the conditions.

COPPER WIRE.—Copper is exported from this country in large quantities. Nevertheless, although there is no duty on copper bars, the commanding position of the copper mining companies enables them to exact about 1 cent per pound (and sometimes more) from American consumers above what the foreigner has to pay. Furthermore, there is the same disparity in wages in the wire drawing industry of the two countries, so that the cost of the copper wire to the American cablemaker is from 10 to 15 per cent greater than the cost to the English manufacturer. There is a tariff duty of 2½ cents per pound on copper wire, so that it is out of the question to import it for the purpose, even if American manufacturers were disposed to do so.

GUTTA PERCHA.—There is, we believe, no tariff duty on this article in the crude state. Nevertheless, since it all comes from the East Indies, and is handled by English factors or importers, practically all at London, the cost to the American manufacturer (including additional commissions, and additional freight and insurance) may fairly be put at 5 to 10 per cent above the cost to the English manufacturers. If the American manufacturer should import this material in a partially manufactured state, the tariff duty would be 35 per cent ad valorem; and a portion of it would probably have to be so imported until the American factories were running absolutely uniform and perfect material from the crude state to a certain degree of refinement.

JUTE YARN.—Immense quantities of this material would be required in making the cable, and the yarn can be procured from American manufacturers. The American prices, however, range from 25 to 35 per cent above the Dundee, Scotland, prices, the American tariff duty being from 1 cent per pound plus 10 per cent ad valorem, up to 35 per cent ad valorem.

IRON ARMOR WIRE.—An enormous quantity of this article will be required for the Pacific cable—somewhat more than half the total weight (the total weight from 1¾ to 2¼ tons per knot). Americans cannot buy the wire abroad and import it, because the duty on such material is 1¼ cents per pound, and American cable producers pay a higher price than do foreigners. On many occasions the difference has been the full tariff of 1¼ cents per pound, which would be from 33⅓ per cent upwards.

CABLE SHIPS.—This question, which has not so far been touched upon, is important. There are no such ships in America, while England has a splendid fleet of them, and other countries also excel us in this respect. It is true our Government has dabbled a bit in converting merchant steamers into cable ships, but the operation has been attended with all the drawbacks that might be expected from such an operation. It is stated by one well-known American manufacturer of insulated wires and cables that an American steamship builder with whom he talked on the matter said that he would charge not less than $750,000 for such a cable ship complete. At least two cable steamers would be required on the Pacific cable enterprise. The Government here might possibly lend a hand with some of our newer transports, but as noted already, they were not built primarily for cable tank capacity or the heavy deck hamper involved in equipping with cable machinery.

As to operation and ownership, the alternative is practically that of private enterprise and Government control. Our own platform of opposition to any extension of municipal or State management to commercial enterprises is too well known to our readers to need restatement here, although we are willing to concede that a modification of our views is inevitable in times of national peril, such as war, when cables, like everything else, are at once subject to the higher considerations. There may also be validity in the contention that a cable is something in the nature of lighthouses and kindred work for the common welfare and protection. In the main, however, fortified by English experience, we prefer cables under private management. We are glad as an offset to present the points as to government control suggested by a well informed student of the matter, it being true that many American manufacturers would prefer government installation and operation.

First.—It seems evident that the Republican majority in both branches of Congress is in favor of Government construction and ownership of the Nicaragua Canal, wherefore Government ownership of the American trans-Pacific cable is not a departure from the principles of the party now in control of national affairs, nor from those of the Nation.

Second.—The means of communication between the people of the several States, and between the United States and foreign countries by mail are provided and operated by the Government, for the benefit of the Nation, and the Pacific cable is merely another means of communication between the United States and its recently acquired outlying possessions, which can otherwise only be reached by the slow process of the mails, or by telegraphing at very great expense, over foreign-owned lines, and through foreign countries.

Third.—Private capital will not undertake the laying and operation of a trans-Pacific cable without freedom to fix its own rates, or a large subsidy from the United States Government every year for a long period of time, and representing altogether about one-half the total cost of the system. If the Government is going to contribute so largely to the establishment and maintenance of this service, it might as well go a little farther and secure to itself and its people the benefits of Government ownership of this means of communication with its outlying Pacific possessions.

Fourth.—In times of war, either between ourselves and other nations, or between several other nations, the cutting of the cable and thus breaking our lines of communication, would be very much less likely to take place if the cable were owned by the Government than if it were a private corporation, and for obvious reasons.

Fifth.—The private corporation would never reduce the rate below the maximum provided for in a subsidy bill, nor would it voluntarily make low rates, whereas the Government would naturally keep on reducing the rate as traffic and earnings increased, to simply make the enterprise pay its operating and maintenance expenses, to the great

advantage of American intercourse and commerce with our Pacific possessions, and the uncounted people of Asia.

Sixth.—The Government can borrow the money to pay for the cable system, at a very much lower rate than any private corporation, besides avoiding the necessity of earning dividends on stock whether "watered" or not, and, therefore, it could unquestionably give the American people the great benefit of much lower rates than a private corporation could possibly give, be it ever so willing.

The Economic Design and Management of Telephone Exchanges—III.

By Arthur V. Abbott, C. E.

2. DISTRIBUTING BOARD, OR CROSS-CONNECTING BOARD.

THE distributing boards are frames, usually of iron, so arranged that all the wires of the wire plant may end on connectors (see Connector), on one side, and the cables from the switchboard on the other side, then by means of flexible pieces of wire called jumpers (see Jumper) it is possible at any time to change the connection of any wire plant wire, to any switchboard wire without disturbing either the wire plant or the switchboard. There are usually two distributing boards, one called the Main Distributing Board, at which all the wire plant wires end, and to which extend all the switchboard cables. If a subscriber moves from one location to another, and must be connected to the office by an entirely different wire route, his switchboard number may be retained by changing the jumper connecting his former switchboard wire to the new wire plant wire. The main distributing board often carries the protection. The other distributing board, called the Intermediate Board, has no protection, and is frequently smaller, about two-thirds the size of the main board. From the main board the switchboard cables pass to one side of the intermediate board, and each wire is then exposed on a connector, then the same cables pass to the multiple in the switchboard. From the *answering jacks and signals* cables go to the other side of the intermediate board, thus by a jumper on the intermediate board any answering jack may be associated with any multiple jack. By this means busy subscribers may be distributed among different operators without changing their numbers or disturbing the multiple cables.

Running Board.—An inferior form of distributing board usually made by placing connectors on wooden strips often located at the bottom of and inside the switchboard frame.

3. POWER PLANT.

The entire apparatus installed in a central office to manufacture, or transform electricity, and deliver it to the telephone switchboard. Power plants are of two types. (a) Those that take electricity from some commercial source and transform the same into the desired electrical supply for telephone service, and (b) those that include a prime mover of some kind, and a dynamo driven therefrom. The first type comprises either a direct or alternating-current rotary transformer, usually installed in duplicate, for converting the electricity supplied by the commercial mains into the desired voltage and current for charging a storage battery. A ringing generator, also in duplicate, consisting of a dynamotor operated from the commercial mains and delivering alternating current for ringing at from 100 to 125 volts and about 16 cycles per second, of a size proportioned to the office, usually ¼, ½ or 1 kw. A storage battery, usually of 10 to 12 cells in series (20 to 24 volts), sometimes of 20 cells (40 volts), of such capacity as to be able to carry the office for at least 36 hours without charging, on the basis of 10 ampere-hours per hundred originating calls. A switchboard equipped with the necessary switches to receive the commercial supply, and handle the transforming machinery and battery, together with all necessary instruments for measuring electricity, and the protection for the power circuits. In the second type, a gas engine, small water motor, or other prime mover is installed to supply power, a low voltage dynamo replaces the rotary transformers, and the ringing generators are operated from the battery. Both these forms of power plant include a fuse board that distributes and carries the necessary protection to guard the leads that supply electricity to the telephone swichboard, and a wire chief's desk supplied with all apparatus necessary to test for, discover and clear, any trouble that may arise in any part of the telephone plant.

4. OPERATORS' FURNITURE.

At every central office proper quarters must be provided for the comfort of the operators. These include necessary toilet facilities and bathroom, a dining room equipped with gas stoves for heating tea and coffee, tables and full set of table utensils and fittings for operators' lunch, a locker room and lockers for the clothing of each operator on duty at once, a parlor reasonably furnished for the comfort of operators when resting, and a hospital in which cases of illness may receive attention. This may be a small ante-room provided with a sofa or cot, or even a portion of the parlor partitioned off with a folding screen. At the switchboard each operator must be provided with an adjustable chair. The manager must be provided with an office properly furnished where he can transact business with the public separate from the operating room.

The chief operator and monitors must be supplied with chairs and desks equipped with telephone sets, signals and call wires to reach any of the operators at the board, the wire chief and each other, and exchange lines for public business. A card catalogue of subscribers, and a card trouble record complete the list.

Branch Terminal or Bridging Board.—In the early multiple switchboards each of the multiple jacks contained a spring contact, and the jacks were arranged in series, so that there were as many contacts as there were jacks, any one of which could be opened by an infinitisimal particle of dirt. By setting the jack springs one on each side of the line, or in parallel, all the spring contacts were avoided, and the troubles due to open lines vanished. Boards with jacks so arranged are called *branch terminals,* or *bridging* boards.

Busy Test.—Such an arrangement of a subscriber's circuit as will inform any operator at any position of the switchboard whether the line is being used. Usually the busy test is accomplished by putting a battery on the sleeve of the plugs; then when a plug is placed in any jack, the rings of all other jacks of the same line are electrified, and any operator touching a charged ring with the tip of a connecting plug will hear a sharp "click" in her telephone.

Cable Forms.—Pieces of multiple wire cable that are to be attached to spring jacks, connectors and the like, must have the ends of the various wires arranged in definite positions to match the apparatus to which attachment is to be made. When the wire ends are thus arranged, lashed, varnished, tested out and marked, the cable is said to be *formed.*

Cable Run.—(a) Supports, preferably of iron, that carry and enclose the various aggregations of cables that connect the different pieces of apparatus in a central office. (b) The passage way or entrance or space including necessary supports provided to allow the cables of the wire plant access to the main distributing board.

Chief Operator.—The attendant who has general charge of a central office.

Circuit.—That combination of electrical apparatus which permits of two parties to be placed within talking relations with each other. In the switchboard, circuits are known as "one-wire," "two-wire" or "three-wire" circuits, depending on the number of main conductors that are required for each subscriber's circuit through the jacks. Circuits are divided into (a) *Subscribers'* circuits, extending from the subscriber's premises and terminating in the switchboard at the exchange, including the answering jack and calling signal. (b) *Operators' Circuits or Cord Circuits,* or those which are used by the operator in the prosecution of the business of the exchange. (c) *Trunk* circuits, or those which are used to extend between two switchboards in different offices.

Cord.—A flexible electrical conductor attached to a plug.

Pair of Cords.—Each plug is supplied with a cord. When the two cords are united by connecting clips a flexible conductor is formed capable of instantly electrically uniting any two jacks. Cords are, therefore, always used in pairs. Cords and plugs are further known as one, two and three-way, depending on the number of conductors they carry.

Cord Shelf.—A projection on the switchboard on which are placed the plugs and keys of the cord circuits, and from which the cords are suspended.

Color Scheme.—Switchboard cables are made up of single wires, wires in pairs, triples, or quadruple, depending on the nature of the circuit for which the cable is to be used. By dying the insulating material covering the various wires with different colors, according to a predetermined code, it is possible to identify at each end of a piece of cable the several wires without resorting to the laborious

process of testing. Such a method of colored insulation is called a *"color scheme."*

Connector.—Sometimes called "terminal," "line terminal," "clip" or "punching"; a U-shaped piece of thin metal having two ears, to which wires may be soldered, used to connect different wires or cables together. For distributing boards connectors are made up on maple blocks, each carrying 10 to 20 pairs.

Jack or Spring Jack.—A contrivance consisting of one or more springs and a ring held in an insulating frame, so designed that when a properly formed metal plug with a corresponding number of conductors is inserted into the ring it may make contact with the various conductors formed by the ring and springs, and extend the circuits, of which they form a part, to corresponding conductors in a flexible cord attached to the plug. Jacks are divided according to their construction, into *one, two, three, four, five* or *six-point* jacks, depending on the number of contacts, or conductors they contain, and according to the use to which they are put into answering jacks, multiple jacks and trunk jacks.

Answering Jack.—The jack which is associated with the subscribers' calling signal, and which in multiple and divided boards is exclusively used by the operator in answering subscribers' calls.

Multiple Jacks.—Those which have no signal, and of which several are attached to each line, so distributed along the switchboard that each operator can reach every line. In multiple boards, multiple jacks are divided in subscribers' multiple jacks and out-trunk multiple jacks, depending on whether they are attached to subscribers' lines or to outgoing trunk lines. The subscribers' multiple is further divided into the "A" multiple, or those jacks which appear before "A" operators, and the "B" multiple those which are placed in front of "B" operators.

Trunk Jacks.—Jacks which form the termni of trunk lines.

Jumper.—A piece of flexible wire, or metal strip, used as a usually more or less temporary connection between two parts of a circuit.

Key.—A switching device whereby different circuits may be connected or disconnected at pleasure.

Ringing Keys.—Keys used for placing ringing current upon lines.

Listening Keys.—Keys to enable the operator to listen to subscribers' orders.

Combination Keys.—Keys which unite both above functions in a single piece of apparatus.

Order Wire or Call Circuit Keys.—Keys used by the operator to connect herself with a call wire.

"Listening" in or Supervising.—The act of an operator in connecting her telephone with the circuit of two subscribers presumably talking together for the purpose of ascertaining whether the subscribers are conversing.

Operator's Load.—The amount of work, or number of messages, an operator can handle in a day's work. On modern switchboards an "A" position should handle from 1600 to 2000 messages per day. A "B" position from 2400 to 3000 messages. On a magneto board a fair "A" position load is from 1100 to 1300 messages, and for a "B" position from 1900 to 2100.

Manager.—The person in charge of a central office.

Peg Count.—The operation of counting the number of originating calls received in a central office during any consecutive 24 hours, for the purpose of ascertaining the load on the office. The result of a peg count when plotted with hours as abscissæ and number of originating messages as ordinates gives the "load" line of the office.

"Position."—The space at a switchboard occupied by one operator, is also used to designate the entire collection of apparatus provided for an operator. Positions are divided in "A" and "B" positions.

Protection.—The apparatus provided to avert injury by abnormal currents to either (a) central office equipment, (b) sub-stations, or (c) wire plant wires.

(a) CENTRAL STATION PROTECTION.

Central station protection usually consists of a spark-gap and heat coil. The spark-gap is composed of two plates, preferably of carbon, one of which is grounded while the other is connected to the line wire, and separated about 1-200 of an inch, usually by a disk of perforated mica or silk. In a recess in one of the carbon plates a small lump of fusible metal (160 degs. solder) is often placed. This lump melts under the heat of the discharge, and flowing across the gap dead grounds the line. The heat coil consists of a small spool of resistance wire (5 to 50 ohms), in the center of which a movable pin is arranged to impinge on a ground plate. Normally, by means of fusible solder, the pin is held off the ground, but in case of an abnormal current of too low-potential to leap the spark-gap, the solder melts and drops the pin to the ground. Common battery boards must have the protection arranged to *open* the switchboard side of the line while *grounding* the wire plant side. Sometimes a light fuse (maxstat 1 ampere) replaces the heat coil, but is not so reliable. The entire protection for each line is placed on the line side of the main distributing board, the carbons and heat coils being mounted in springs to be readily replacable after performing their functions.

(b) SUB-STATION PROTECTION.

The sub-station protection includes the same features as that for the central office, to which a fuse (7 amperes) is frequently added, the whole apparatus placed on a porcelain block located near the sub-station set (see Sub-station Set), or preferably on the wall of the building near the point where the line enters.

(c) CABLE PROTECTION.

At the point where a cable runs into an open wire line it is usual to place a fuse (3 to 7 amperes) between each cable wire and the open wire. When a cross takes place between a telephone wire and a wire carrying electricity at relatively high potential, the protection at the sub-station or central office operates and grounds the line, a rush of current then blows the fuse at the sub-station or at the junction of the cable or both, isolating the open wire from both the cable and the sub-station. Much difference of expert opinion exists as to the extent to which protection should be employed. There are many advocates of the entire omission of protection from underground lines and wide disagreement as to how far aerial lines should be guarded. Saving in expense is the only argument against the complete system as outlined. While protection devices are not infallible, to omit any of them is courting a risk that a conservative policy would shun.

Plug.—A small rod of brass shaped to fit a jack and used to connect the jack to a flexible cord. Plugs are divided into (a) answering plugs, or those which are only inserted in the jacks of subscribers making calls, placed next to the face of the switchboard on the cord shelf. (b) Connecting plugs, or those which are only inserted in the jacks of subscribers that are to be called, placed nearest the operator on the cord shelf.

Relay.—An electromagnetic device consisting of an electromagnet that when excited attracts a movable armature, thus completing a circuit. Relays are divided into (a) *Line relays,* or those which are used by subscribers for signaling the exchange; (b) *Cut-off* or *Controlling relays,* or those which are used to isolate a subscriber's line from its answering jack and signal; (c) *Supervisory relays,* or those which control the supervisory signals. (d) *Pilot Relays,* or those common to a number of signals acting as a general guard in case of failure of any individual relay.

Signals.—A device for calling the attention of an operator. Signals are divided into *Line* or *Calling* signals, or those attached to subscribers' lines for the purpose of notifying an "A" operator that a subscriber desires a connection. *Clearing out* or *Supervisory* signals that are attached to the cord circuits of both "A" and "B" operators, chiefly used to notify operators that conversation is completed; and *Pilot Signals,* or those which are common to or are in parallel with a group of other signals and serve to call attention to the fact that some other signal is displayed. Example: A night bell connected to all the signals of a magneto board. Signals may also be classed by their operation into *Manual* signals, or those that after being displayed must be restored by hand to their normal position, and *Automatic* or *Self-restoring* signals that take care of themselves. The ordinary annunciator, an electromagnet that when exicted attracts its armature, and allows a shutter to fall by gravity, displaying a number, is an example of the first class. Such a signal is usually called a *"Drop."* Of the second class the miniature electric lamps of the modern switchboards form the best example.

Supervisor.—An operator who has charge of a division of the switchboards, supervising a group of operators, and reporting to the chief operator.

Terminals.—Telephone circuits usually contain many different pieces of apparatus, and frequently several kinds of cable or wire. When one piece of apparatus or kind of wire is to be joined to another, a great variety of connecting devices are used, all of which pass under the generic name of *terminal.*

Wire Chief.—The attendant who has charge of the power plant, and supervision of the switchboard. In many cases the wire chief has also more or less charge of the maintenance of the aerial wire plant, and sometimes is expected to run lines for new subscribers.

Development of the Indiana Telephone Field.

By R. D. Fisher.

THE development of the Indiana telephone field is not only remarkable for its rapid progress, permanency and convenience, but stands as a monument to skill, science, modern improvements, wise business sagacity and management. The results of the expenditure of millions of dollars is a network of lines radiating from the centers of population into every part of the State. According to the recent valuable report of the Auditor of State there were on the first day of April 110 incorporated telephone companies owning and operating telephone plants and lines in the State. There were also a number of voluntary associations and private lines not included in the above estimate. The assessed valuation of their lines alone was $4,436,663. The valuation per mile, as fixed by the State Tax Commissioners, shows the surprising and apparently inequitable variation of $5 to $500. Real estate, machinery, switchboards, instruments, office fixtures, etc., are valued by local assessors and are not included in the above estimate. There are 152,702.03 miles of telephone wire in operation in the State on the first day of April.

The past season (eight months) has been one fraught with important events, and the Indiana field has been among the most active in telephone development. A score or more new companies have been incorporated, and an equal number of plants installed. There were in April 22,000 Central Union telephones and 52,469 independent telephones in use, whereas, during the past eight months the number has increased at least 30 per cent. Indiana has a population of nearly 3,000,000 people. There are 92 counties in the State. On April 1 there were several counties without telephones, and no toll stations were maintained within their borders. To-day there is telephone service in every country of the State, and nearly one-half of the people can communicate with each other and with the outside world.

Doubtless among the companies constituting the independent chain, the most aggressive is the Hon. S. P. Sheerin's New Telephone Company, of Indianapolis, including that company's long-distance lines. It had on April 1, 4,486.50 miles of wire in operation, but the company's development during the past eight months has increased the capacity of the long-distance and local plants at least 50 per cent, and the encouraging fact remains that the demand for telephones is greater than ever before. Lines are now being built to Logansport, Peru, Jeffersonville and Louisville, and preliminary arrangements have been completed for the building of projected lines to Vincennes, Washington, Evansville and Muncie. "The outlook is better than ever," said General Manager Sale, of the New Long Distance Company. "We have been granted within the past month franchises on conservative terms at Washington, Vincennes, Logansport and South Bend, and have a petition pending at Muncie. Our new plants at New Castle and Peru are nearing completion and will shortly be in operation." Great activity in telephone development is also manifest in northeastern Indiana, where Mr. George W. Beers and business associates have labored for several years with great success and profit. The Home Telephone Company, of Ft. Wayne, of which Mr. Beers is president, has 350 miles of wire in Allen County; the National, 219 miles, and the Citizens' Company, 51 miles. Mr. Beers' operations are not confined to Allen County. Indeed, he has control of a number of companies operaitng in adjacent counties, and has recently secured the control of the Anderson Telephone Company. The lines are being extended, the plants in general are being improved, and the latest appliances adopted. One notable and beneficial improvement is the increasing number of exchanges, and the fact that long, heavily taxed party lines are growing in disfavor. The work of connecting the numerous farmers' lines with the village exchanges and the village exchanges with the county seat exchanges, and these in turn with the long-distance lines has been going on among the independent companies all summer until it is now the boast of the managers of this combination of interests that the Indiana farmer, sitting in his home, can communicate by telephone all over the State. The equipments of country lines and of country and village exchanges have been greatly improved. Opposition by abutting landowners has faded away, and the telephone is now accorded its proper and legal use in the highway. Telephones are being placed in some of the country school houses, and in one instance an exchange is operated in a public school building.

While the development of the Indiana field is largely due to the independent movement, the Bell companies, all over the State, under the energetic new Sabin regime, have become strong competitors, both in extensions and in improvements. This company has nearly 40,000 miles of wire in operation in the State, making many improvements and extensions during the year. But the Independents maintain that the people—the business interests and the farmers—still remain partial to the independent companies. At present Indiana is deficient on toll lines, but this is being remedied as fast as possible. In a short time the entire State will be connected up ready to jump over into bordering States, reach across the Alleghenies to the east and the Mississippi to the west.

Telephone Activity in Pittsburg and Western Pennsylvania.

The telephone business has never enjoyed a period of activity to equal the last year. All existing lines have been greatly extended and improved, while our new company has gone into actual operation and, by its great push and energetic action, is to-day a thoroughly established and well equipped competitor of the older companies. The situation in Pittsburg and the surrounding territory is an interesting one. The Central District & Printing Telegraph Company, which was organized in Pittsburg in 1874 as a telegraph company, is the oldest telephone company in this part of Pennsylvania. It is the licensee of the Bell company. The company next in importance is the Pittsburg & Allegheny Telephone Company, which came into the city a little over two years ago. It is now doing a remarkable business, and its subscribers already number several thousand. The third company is the Federal Telephone Company. It has no franchise nor connections in the city proper, and it confines its operations to the boroughs, villages and towns outside of Pittsburg, which are scattered throughout Western Pennsylvania, and it must be admitted that it also has done a great deal of work. It is also adding new exchanges as rapidly as franchises and ordinances are passed in its favor.

To get an adequate idea of the wonderful amount of work, which has been done by the different companies, it is interesting to get their reports, which in actual facts and figures speak for themselves.

Beginning with the C. D. & P. T. Company, the oldest one, here are some of the items:

MILES OF POLES, JAN. 1, 1901.	
Exchange	1211
Toll line	2752
	3963

MILES OF POLES, NOV. 1, 1901.	
Exchange	1349
Toll line	3200
	4549

Showing an increase of almost 20 per cent in eleven months.

MILEAGE OF WIRE, JAN. 1, 1901.	
Exchange	61,265
Toll line	16,150
	77,415

MILEAGE OF WIRE, NOV. 1, 1901.	
Exchange	78,480
Toll line	17,485
	95,965

This shows an increase of almost 25 per cent.

The cost of additions made to the system in buildings and real estate during the first ten months of this year ending October, 1901, not including switchboards, wire and other apparatus:

Plants	$743,539.43
Real estate	50,190.26
	$793,729.69
Number of telephones in use by the company, Jan. 1, 1901	35,509
Those in use Nov, 1, 1901	39,031
Increase	3,522

The improvements, which the company has made throughout its system during the last year, are really remarkable, and their magnitude cannot be appreciated unless they are mentioned in detail.

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

At the Grant exchange it put into operation the relay board and the common battery system. The South Side exchange has been transferred to a new building erected for telephone purposes. A relay board was also installed there. The Fisk or Lawrenceville exchange has been equipped with the common battery system and the exchange building has been remodeled. The Park exchange building was completed during the year, and new apparatus was installed. The East exchange was also remodeled, and a relay switchboard is now being installed. The Hill exchange has been transferred into a building purchased for that purpose, and a common battery and switchboard has been put into operation. At Wilkinsburg, a suburb of the city of Pittsburg, a new exchange building is in course of construction, and orders for a new switchboard have already been issued. The work on the new building of the Court exchange in this city is also being pushed as rapidly as possible. This work has been delayed because in digging the foundation the contractors struck a quarry of very hard stone. The company is also completing new buildings for exchanges at Marietta, Ohio, and at Parkersburg, W. Va. The switchboard at Marietta has already been delivered at the building. The principal part of the city has been provided with underground conduits. The company has reconstructed its exchange and plant at Franklin, Pa., underground conduit has been put in and a new switchboard has been installed. At East Liverpool, Ohio, another exchange plant of the local company, an underground system is being put in. The architects have prepared other plans for a new building, which will be erected as soon as the bids are in, and a new relay switchboard will be installed. At Wheeling, W. Va., the C. D. & P. T. has extended its underground system so as to take in South Wheeling. The old exchange at this last place will be abandoned, and, in order to improve the service, all connections will be formed from the main exchange in Wheeling. During the past year the company has also rebuilt the branch exchanges in the Beaver Valley at Beaver, Beaver Falls, New Brighton, Rochester and Monaca.

The Pittsburg & Allegheny Telephone Company, the local competitor of the C. D. & P. T., has been in operation about two years. During that time it has succeeded in connecting up between 7500 and 8000 telephones distributed over Pittsburg, Allegheny, Coraopolis, McKees Rocks, Carnegie, Braddock, Homestead, Swissvale, Wilkinsburg, Verona and New Kensington. At Bellevue, Pa., and Sewickley, Pa., new exchanges are being established at present. This company does most of its circuit work underground. It has practically two subways completed between the city proper and Wilkinsburg, a distance of nine miles. The company is adding from 20 to 30 new telephones a day. It has now completed arrangements for long-distance connections with Cleveland, Ohio; Erie, Pa., and all intermediate points. The company prides itself upon the phenomenal success it has met with in this territory, and it claims that this success was made possible by low rates and good service.

By Nov. 26, 1901, Federal Telephone lines had been extended into all of the following named places in Western Pennsylvania. In addition thereto it has secured franchises in several towns not mentioned hereon, and will extend its lines to many other points during 1902.

ALLEGHENY COUNTY.—Bellevue, Avalon, Ben Avon, Emsworth, Clifton, Dixmont, Glenfield, Haysville, Osborne, Sewickley, Edgeworth, Shields, Leetsdale, Fair Oaks, Coraopolis, Esplen, McKees Rocks, Carnegie, Woodville, Bower Hill, Bridgeville, Millvale, Etna, Verona, Oakmont, Wilkinsburg, Wilmerding, Wall, Pitcairn, East McKeesport, McKeesport, Versailles, Port Vue, Glassport, Duquesne, Dravosburg, Belle Bridge, Elizabeth, West Elizabeth, Lock No. 3, Bunola, Elkhorn.

BEAVER COUNTY.—Economy, Baden, Remington, Conway, Freedom, Monaca, Aliquippa.

WASHINGTON COUNTY.—West Brownsville, California, Coal Centre, Elco (Wood Run), Roscoe (Lucyville), Stockdale, Allenport, Speers, Charleroi, Monongahela City, North Charleroi, Courtney, Finleyville, Washington, North Washington, South Washington, West Washington, East Washington, Canonsburg, South Canonsburg.

WESTMORELAND COUNTY.—Monessen, Irwin, Latrobe, Youngstown, New Kensington, North Belle Vernon, Manor, Baggaley, Hyde Park, Avonmore, Saltsburg.

FAYETTE COUNTY.—Brownsville, Fayette City, Bridgeport, Belle Vernon.

ARMSTRONG COUNTY.—Freeport, Leechburg. This makes a total of 87.

Marconi Signals Across the Atlantic.

WILLIAM MARCONI.

THE readers of Sunday newspapers were treated with a sensation of the first order by the announcement last Sunday morning that Marconi had received during the previous week several signals at St. Johns, Newfoundland, transmitted from Cornwall, England. It now appears that before leaving England Marconi had made plans for accomplishing this result, though it was given out that his object in coming to Newfoundland was to establish a station for communication with ships at sea. It is quite probable that the publication of the results achieved was unauthorized, the experiments being merely preliminary ones of a scientific rather than practical nature.

The distance between the Cornwall station at Poldhu, Cornwall, from which the signals were sent, and that on Signal Hill, Newfoundland, where they were received, is about 2100 land miles. The signals consisted in repetitions of three dots, corresponding to the letter "S" in the Morse code, and were audible in a delicate telephone connected with the receiving apparatus.

As previously stated before leaving England, Marconi had arranged with the electrician in charge of the Cornwall station, to begin sending signals daily after a certain date, which Marconi would cable him upon perfecting his arrangements at St. Johns, where he arrived several weeks ago. Signal Hill, at the entrance to the harbor, was selected as an experimenting station, and his equipment was installed there. On Dec. 9 he cabled the Poldhu station to begin sending signals at 3 P. M. daily, and to continue them until 6 P. M., these hours being, respectively, 11.30 A. M. to 2.30 P. M., St. Johns time. During these hours Wednesday Marconi elevated a kite with

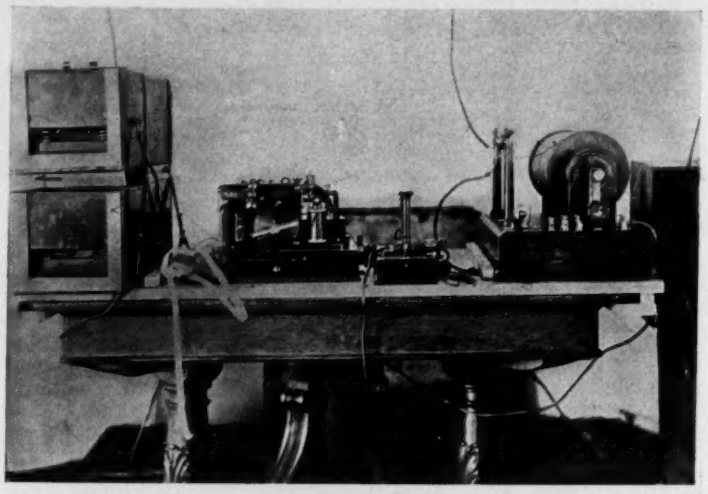


FIG. 1.—STANDARD MARCONI APPARATUS.

an aerial wire. He remained at the recorder attached to the receiving apparatus, and, to his profound satisfaction, signals were received by him at intervals, according to the programme arranged previously with the operator at Poldhu. These signals, as stated before, consisted of repeating at intervals the letter "S," which is made by three dots, or quick strokes. This signal was repeated so frequently, and according to the detailed plan arranged to provide safeguards against possibility of a mistake, that Marconi was satisfied that it was a genuine transmission from England. Again on Thursday, during the same hours, the kite was elevated and the same signals were renewed.

Though satisfied of the genuineness of the signals and that he has succeeded in his attempts to establish communication across the Atlantic without the use of wires, Marconi wishes it understood that the system is yet only in an embryonic stage. The possibility of its ultimate development is, however, demonstrated by the success of the present experiments with incomplete and imperfect apparatus, as the

signals can only be received by the most sensitively adjusted apparatus, working under great difficulties, owing to the conditions prevailing at St. Johns.

In a letter in Tuesday's *New York Herald* Marconi gives the following account of the experiments:

"Before leaving England I arranged for our long-distance station near the Lizard to signal me the letter 'S' repeatedly for three hours when I had advised them that I was ready to receive the same. I cabled on Monday that all was in readiness, and asked the signal to be sent at short intervals between 3 o'clock and 6 o'clock, Greenwich time, and to be continued each day until ordered to stop. This time would correspond approximately with 11.30 to 2.30 here.

"I received on Thursday indications of the signals at 12.30, and with certainty and unmistakable clearness; at 10 minutes after 1 quite a succession of 'S's' were received with distinctness. A further number were received at 20 minutes after 2, the latter not so good. Signals were received Friday at 28 minutes after 1 o'clock, but not so distinct as on Thursday.

"I am of the opinion that the reason why I did not obtain continuous results were, first, the fluctuations in the height of the kite, which suspended the aerial wire, and, second, the extreme delicacy of my receiving instruments, which were very sensitive and had to be adjusted repeatedly during the course of the experiments.

"When a permanent station is installed here I will not be dependent upon fluctuations of the wind, and I am confident of making the signals strong and reliable—that is, not requiring such delicate and sensitive receiving instruments by employing much greater power at the sending station.

"I must go immediately to England to make arrangement for employing more power at the sending station, and I trust in a very short time to establish communication between the two continents in a thoroughly reliable and commercial manner."

An unexpected development following the announcement of Marconi's success was a warning from the Anglo-American Telegraph Company that if he persists in his work in Newfoundland an injunction will be served. In a letter served on Marconi on Sunday the solicitors of the cable company gave notice on behalf of the company that the sole and exclusive rights to operate or construct any system or means by which telegraphic communication is obtained from any places in the colony or within the jurisdiction of the government of the colony to places outside the colony are owned by it, consequently they notify him that the work in which he is engaged is in direct violation of the rights and privileges granted to the company by its charter from the government.

The solicitors add that unless they receive promptly an intimation that he will not proceed further with his present work and remove the appliances he has erected for the purpose of telegraphic communication, legal proceedings will be begun to restrain him from further prosecution of work and also for any damages which the company may sustain or has sustained. They further notify Mr. Marconi that the company will hold him responsible for any loss or damage sustained by reason of his trespass upon their rights.

To a *New York Herald* representative Marconi expressed himself as follows regarding this notification:

"I entirely disclaim any intention of infringing upon the rights of the Anglo-American Telegraph Company. I was aware that it had a monopoly here for another two years, but I thought it was simply an ordinary commercial monopoly, by which no other company could enter into competition, and I had no intention of competing in the ordinary business sense until the charter had expired. It seems incredible to me that this monopoly should extend so far as to prevent my making such scientific experiments as during the last week.

"It is too late to-night for me to consult my own solicitors, but I shall lay the matter before them in the morning. It appears to me that this letter practically admits the success of my experiments and should remove any doubt, if such can exist, in the minds of the public, as to the truth of my report that I have really had a communication 2000 miles without wires or cables. I intended giving an important exhibition of tests on Signal Hill to-morrow to Sir Cavendish Boyle and a number of gentlemen interested, but I fear I will not now be able to do so."

Mr. A. M. Mackay, general superintendent of the Anglo-American Telegraph Company, referred to the notification as follows:

"When Mr. Marconi came here he announced that his visit was in connection with proposed small stations on the southeast coast in connection with lighthouses and fog alarms, and a future extension of his system on Labrador. He mentioned that while here he would conduct a few experiments and try to communicate with passing ocean liners.

"Thinking this was the full extent of his operations here, our company did not object. It was never for one moment supposed he was going to try to obtain signals across the Atlantic, or we would, in self-defense, have been compelled to apply for an injunction against him as soon as he landed here. His doing this is a direct infringement of our rights under government charter, and my instructions are to notify him promptly and take necessary steps to restrain him from making any further experiments. These instructions were carried out."

FIG. 2.—VIEW LANDWARD FROM SIGNAL HILL.

FIG. 3.—VIEW SEAWARD FROM SIGNAL HILL.

According to press dispatches Marconi will inaugurate the new year by sending a special message, if the steamship on which he will sail Thursday of this week, reaches England on time. He will go direct to Cornwall and take charge of matters there.

Dr. Pupin is quoted as saying that he fully believes that Marconi succeeded in signaling between the coasts of Newfoundland and Cornwall, England, by his system of wireless telegraphy. "According to the newspaper reports I have read the signals were very faint, but that has little to do with it. The distance, which is about 1800 sea miles between these two points, was overcome, and further development of the sending instruments is all that is required.

"Two years ago, in a discussion before the Institute of Electrical Engineers, I expressed an opinion that improvements to the system would overcome the distance. This new system, if it is adopted, will not affect the cables so far as I can see at the present time, for it must be understood that the cables are being perfected constantly. At the present time there are 14 cables between Europe and America, and each one of these cables works much faster than the Marconi system can work over short distances, and, besides, nobody doubts at the present time that the cable will soon be made from 40 to 50 times as fast as it is at the present day.

"One point which is of great value and interest to the scientific world is that Marconi has proved conclusively that the curvature of the earth is no obstacle to the system of wireless telegraphy. Some were inclined to think, and there were many heated discussion upon it, that the curvature limited the system.

"All Marconi's efforts of late have been directed toward perfecting and making his sending apparatus more powerful and giving a greater height to the sending end. It still remains to be proved, however, that heavy banks of fog, low hanging clouds and heavy showers along and in the path of the transmitted electric wave will not entirely obstruct its progress. The presumption generally is that they will, as experiments thus far have proved them so. Atmospheric conditions have also much to do with and strongly affect the electric wave.

"One great drawback of the system is that you cannot work more than one set of instruments at any one time between two continents on account of mutual interference. Marconi deserves great credit for pushing this great work so persistently and intelligently, and it is only to be regretted that there are so many so-called scientists and electricians who are trying to get around Marconi's patent and thus deprive him and his people of the credit and benefits of the work to which they are fully entitled."

Marconi's achievement in first detecting a wireless telegraphic signal from across the Atlantic naturally draws attention to the spot on which the feat was accomplished. This is not the first time that the island of Newfoundland has formed a center of interest from such a cause, for it was there, in 1858, that the earliest word came in over the transatlantic cable. The condition of distance ruled it thus in the one case as in the other, for this triangular island forms virtually the elbow of the continent, stretching out farthest of any point in the temperate zone toward the European shore. On the outer side of Newfoundland is a peninsula which juts from the island as that

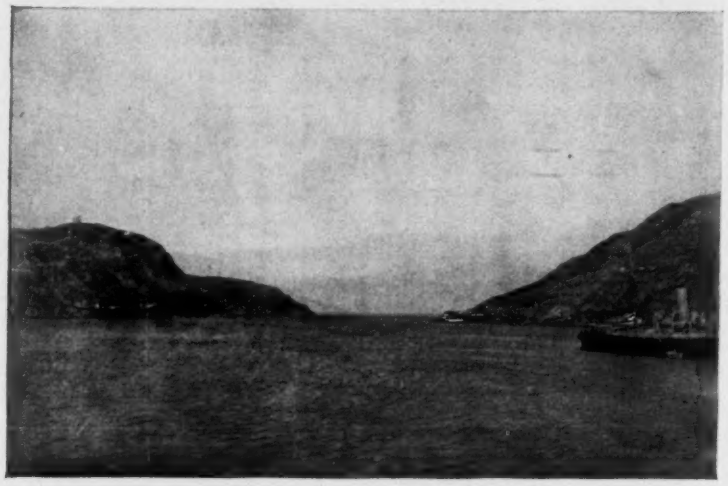


FIG. 4.—ST. JOHN'S HARBOR. SIGNAL HILL ON THE LEFT.

does from the Canadian coast, and on the extreme eastern reach of this peninsula of Avalon rise the two tall rugged promentories which guard the harbor of St. Johns. It was from Signal Hill—520 ft. high—which stands as the northern post of the harbor gate, that Marconi flew his kite.

From the business district of the town it is a drive of only a mile or so to the top of the Signal Hill. The road winds up past the ruins of an old fort, which the driver points out as a French one, for during the seventeenth century St. Johns was in and out of French possession at intervals. The last time the town changed hands was in 1762, when, after a desperate fight, Signal Hill was stormed and taken by the British. But the islanders are not entirely done with the French even yet, for the Treaty Shore rights are a perennial trouble to the West Coast of the colony.

Once on top of the Signal Hill the view in all directions is magnificent, especially along the serrated line of headlands to the northward; in fact, it is as good a place for an outlook as you can find unless you come from the U. S. A. and have been so perverted by yarns about Newfoundland fogs that you will not admit your ability to see farther than the edge of the cliff. The stone castle on the summit is a monument founded in 1897 to the late John Cabot, discoverer of the island, which has been discovered a good many times since, and will have to be a good many times more before the public finds out what an interesting place it is. The utilitarian natives do not appreciate the sentiment of keeping it holy as a tombstone to a departed friend, so they have employed it as a signal tower. Perhaps their object is to warn off future discoverers. At any rate, their signal pole is a good likeness to the gallows on which John Cabot was hanged—if he was hanged. For every-day purposes the people of St. Johns built their gibbet on an inferior mound near the Signal Hill.

Newfoundland is a country undoubtedly destined to a great electrical future because of its countless lakes and mountain torrents available for power. St. Johns has now a trolley road with Westinghouse equipment. It is supplied with current from a 1600-hp plant situated about 8 miles out of town. Early last August the cars were all tied up, and nobody seemed to care. They said the water had given out, but it was also intimated that some of Mr. Reid's affairs with Parliament had occasioned the suspension. Moreover, the colony is a contributor to the electrical manufacturing industry, for a good deal of copper is taken out of the ground.

Electricity for a Pennsylvania Railroad New York Tunnel.

Great interest has naturally been aroused in New York City by the announcement of the Pennsylvania Railroad Company of its intention to establish a great terminal station in the heart of New York City, namely, in the vicinity of Herald Square and West Thirty-Fourth Street. The official statement of President Cassatt is in part as follows:

"The Pennsylvania Railroad Company is now prepared to carry out its policy, long since adopted, of extending its railroad into New York City, therein establishing a suitable passenger terminus for the accommodation of the public. To accomplish this on a comprehensive plan the Long Island Extension Railroad Company will withdraw its application for powers to construct its terminal railroad, and in lieu of such independent construction it is now proposed to build, under the charter of the Pennsylvania-New York Extension Railroad Company, just organized, and a New Jersey railroad company, about to be organized, a through underground connection between the Long Island Railroad and the Pennsylvania lines in New Jersey, and to construct a proper and commodious joint underground terminal station in New York City for the Pennsylvania and Long Island roads.

"After years of exhaustive study the conclusion has been reached that a tunnel line, operated by electricity, is in every way the most practical, economical, and the best both for the interests of the railroad company and of the city. The line as adopted will traverse the city of New York from the Hudson River to the East River, and be underground throughout, and at such depth as not to interfere with the future construction of subways by the city on all its avenues, similar to the one now building along Fourth Avenue.

"As the railroad will be wholly underground and operated electrically, in the same manner as the recently constructed Orleans Railway Extension in Paris, it will not be objectionable in any way. There will not be any smoke, dirt or noise, and as all the surface property may be built upon after being utilized underneath for railroad purposes, the neighborhood of the station will be improved instead of marred, as is so often the case when railroad lines are constructed on the surface or elevated."

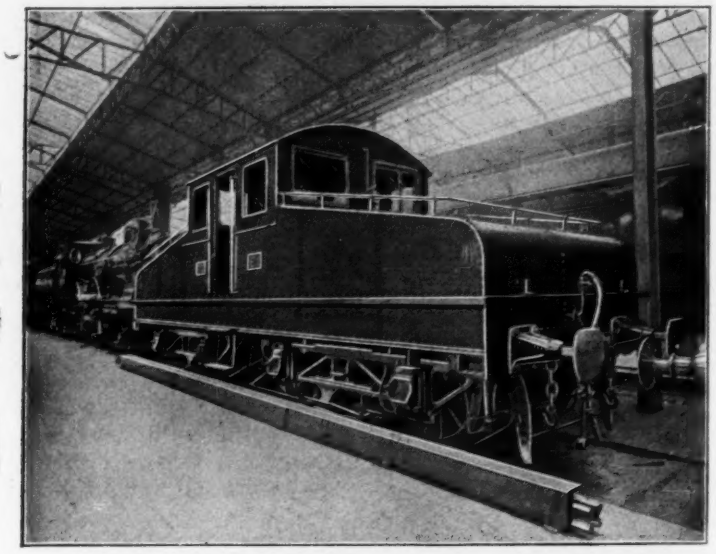
Previous plans had contemplated the construction of a bridge, but according to the plans which were prepared by Charles M. Jacobs, of the firm of Jacobs & Davies, experts in tunnel building, the tunnel will be practically a submerged bridge. This bridge will be enclosed in a steel tube to keep out the water and the mud, and it will rest on piers built on piles, which will be driven down through the mud and sand until they reach bed rock. One of the main reasons for abandoning the scheme of building a bridge across the North River was the tremendous cost. The tunnel will, it is estimated, cost not more than $15,000,000 or $20,000,000, and it may be possible to construct it for less. It will be used exclusively by the Pennsylvania Railroad and its connection, the Long Island Railroad.

The Manhattan terminal for the North and East River tunnel will be on the newly acquired property between Thirty-second and Thirty-third streets, and Seventh and Tenth avenues. Here a large station will be erected. This is to be a magnificent structure architecturally, and for this reason alone it is believed that it will raise the character and value of the surrounding property. From the street level there will be a gradual decline to a platform 100 ft. long, where there will be electric elevators and stairways leading down to the tracks, of which there will be some 20 or more. The train platforms will aggregate several miles, and the dimensions of the station will be 1500

by 520 ft. in length and width, respectively. The tunnel proper will consist of between two and four steel tubes, the exact number not having been decided upon as yet. Each of these tubes will be 18½ ft. in diamter on the inside and 19½ ft. on the outside. Within these tubes will be the bridge construction on which the tracks will be laid. At present it is the intention to build the Hudson tunnel from a point just north of the present Pennsylvania station. The Island of Manhattan will be reached at Thirty-third Street and Thirteenth Avenue.

The grade through the tunnel will be about 1½ per cent, or about a foot and a half in every hundred. At Seventh Avenue the elevation will be about 100 ft. above the bed of the river and about 40 ft. below the street level. The tunnel will then gradually drop until at Tenth Avenue it will be only 40 ft. above the bed of the Hudson. At Eleventh Avenue it will have dipped 30 ft. more, and at Thirteenth Avenue it will be 10 ft. below the river bed. It will then continue gradually to decline until at midstream it will have reached a depth of nearly 100 ft. below the surface of the river bottom.

The trains which will run through the tunnel will be operated by electricity. This will obviate any special arrangements for ventilation, as each train running through it will carry with it a wave of fresh air. The tunnel will be electrically lighted and will practically be as light as day. The power for the motors and the light will be furnished by a large plant which will be built on the New Jersey shore, for the reason that coal is cheaper there than in New York. The motors will be used only in the tunnel, and will be switched on



ELECTRIC LOCOMOTIVE, PARIS-ORLEANS RAILROAD.

in place of a regular locomotive during the regular stop of the trains in Jersey City and in Long Island City.

To complete the entire work will take the continuous labor of three years, so that the tunnel will be ready for operation in the early part of 1905 if the permission to build the tunnel is not unduly delayed. When it is completed the Pennsylvania Railroad will not only have an entrance into New York, but will be able to send through trains without the use of ferries from all New England points to the South and West in connection with the New Haven Road and a bridge from Mott Haven to Long Island, which is to be built by a separate company.

Reference having been made by the Pennsylvania authorities to the work in the Paris-Orleans Railroad tunnel with electric locomotives of the type under consideration here, we show one of them. There are eight built by the General Electric Company at Schenectady, and supplied through the French Thomson-Houston Company. Each is equipped with four motors, and is capable of hauling a train of 300 tons, exclusive of the locomotive, a distance of 2½ miles in 7 minutes, with a grade of 1.1 per cent maximum, between the old depot where the tunnel begins and the handsome new one in the heart of the city, on the Seine, nearly opposite Notre Dame and the Tuilleries. Current is picked up from a third rail by six shoes, and by an overhead device for switching points. Direct current is used. The locomotives weigh only 45 tons, and it is said that only 150 trains per day, both ways, have to be handled. They are quite successful, but the Pennsylvania work would be much heavier in every respect.

New Telephone Patents.

To the U. S. Patent issues of Dec. 10 telephony yields five patents. Of these two relate to receivers, two to switchboard systems and one to the philosopher's stone of telephony, the telephonic relay. This relay is the invention of Mr. George A. Cardwell, of New York, and like most of its forerunners in the Patent Office records, is of the single-track variety. It consists (Fig. 1) of a D-shaped permanent magnet, with opposing polar extensions, each carrying two coils of equal resistance. Between the gap of these extensions is a tuning fork, the tines being in close proximity to the ends of extensions. Between the tines is a carbon microphone arrangement, the disks being secured, respectively, to the fork tines. The line current passes through one pair of the above-mentioned coils. The microphone is connected to a battery and the primary of an induction coil, the secondary of which is connected to the second pair of coils. In the microphone circuit is also another battery and induction coil, the secondary of which is in the relay or outgoing line, *S*.

The action of the relay is as follows: Pulsations of current from the main line in one pair of the magnet coils cause the vibration of the two arms of the fork in equal and opposite directions, thereby varying the pressure between the microphonic disks. The circuit from local battery passing through the disks is caused to pulsate in unison with the pulsations of the main line, thereby causing similar pulsations in the circuit which traverses the second pair of coils and producing a magnetic effect on the cores, which reinforces the magnetic effect of the pulsations of the main line. The local or outgoing

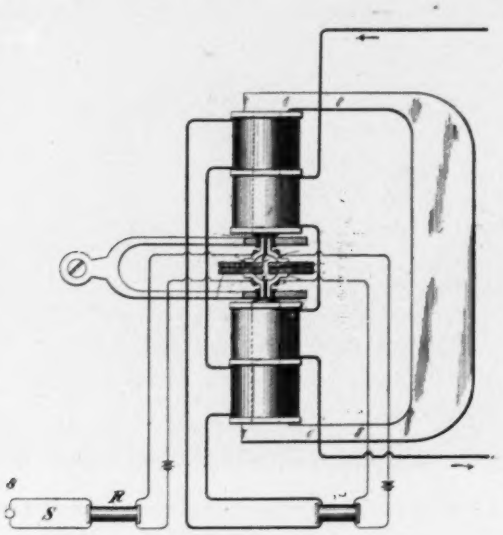


FIG. 1.—CARDWELL TELEPHONE RELAY.

circuit from the second battery passes through the microphone disks, and its current is caused to pulsate by the varying pressure between said disks and in unison with the pulsations in the main line. Through the induction coil *R* this current will cause similar pulsations in the outgoing line *S*, which line includes the receiver *s*.

One of the two patents on receivers is granted to Mr. William S. Paca, of Baltimore, and the invention is of delightful simplicity, as it consists of fitting a damper into a hole made in the center of the core of the electromagnet. The damper may be made of any suitable material—such as felt, leather, soft rubber, or an equivalent—and is provided with a flattened head against which the diaphragm will make contact lightly when the receiver is in use. In the words of the inventer, "the damper will extend beyond the face of the core of the magnet a sufficient distance to keep the diaphragm from contacting with the core proper of the magnet, but will not in any respect interfere with the proper attraction between the diaphragm and the core, the effect being merely to limit the vibration of the diaphragm, and thus prevent objectionably loud sounds being produced in the ear of the user caused by excessive currents in the electromagnet and overcome any buzzing or blurring in the receiver."

A receiver in which a considerable departure from the regular methods of assembling the standard elements of a receiver is patented by Mr. Francis J. Orr, of Holland, N. Y. In Mr. Orr's invention the cores of the electromagnet are mounted on a metal diaphragm, which is attached at its center to a block inserted between the prongs of the permanent magnet and at its periphery to the re-

ceiver case. The electromagnet cores pass through this diaphragm so as to impinge on the poles of the permanent magnet. The inner ends of the windings of the magnet coils are connected by means of a miniature microphone, formed of a small rod of metal or carbon with its ends resting loosely in sockets of the adjusting screws to which the wires of the coils are attached. Opposite the working ends of the electromagnet cores is the regulation diaphragm and clamped forward of this, spaced between the diaphragm and the earpiece is a second diaphragm, which has a circular opening in the center of substantially the same size as the opening in the earpiece.

Mr. Orr claims that with his receiver the sound produced will be very much increased and clearer as compared with receivers in ordinary use, and that "the usual buzzing and roaring" are obviated. The microphonic joint between the windings of the magnet coils causes the sound produced to be materially increased by the slight vibration of the microphone. Further, in the inventor's own words, "the inner plate, vibrating at every impulse or wave of the human voice, controls or causes a unison of the vibration of the two diaphragms with the plate, and this plate is somewhat heavier or thicker than the diaphragms. The result is that one is able to hear clearly when the vibrations in the ordinary type of receiver are utterly unintelligible." While there is certainly a distinct element of difference between this and the ordinary run of receiver inventions, it is difficult to see why the receiver should be more sensitive than the ordinary receiver to voice vibrations, and at the same time less sensitive to "the usual buzzing and roaring." The fundamental difficulty is that no receiver can reproduce what the line does not deliver to it, and troubles in hearing, or buzzing and roaring, are really in the line.

To Mr. Harry G. Webster, of Chicago, is granted a patent on a novel switchboard system, the patent being assigned to the Stromberg-Carlson Telephone Manufacturing Company. Mr. Webster's invention is designed to effect the automatic cut-out of the line signal,

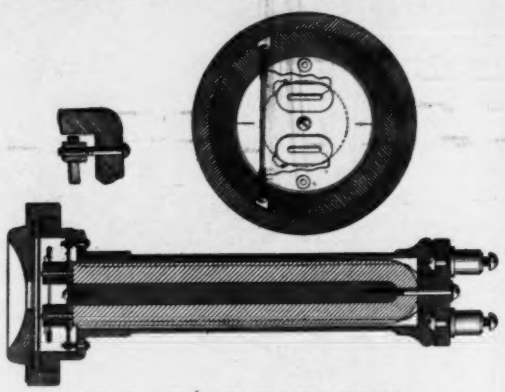


FIG. 2.—ORR'S TELEPHONE RECEIVER.

when the answering plug is inserted in the jack, without the use of the customary cut-off relay and its associated switching mechanism. The inventor, however, does not wish to be limited to a common battery system. The invention is shown in connection with a common battery, and the disclaimer is rather excess of caution, since cut-off relays are not used with the magneto system. The essence of Mr. Webster's invention consists in the use of a differentially wound relay whose armature controls a switch that throws the line from the line-signal to the answering jack. Under normal conditions current from the common battery flows through both coils of the relay, and the coils opposing each other the relay is inert. The insertion of the plug in the answering jack makes a circuit that shunts one coil of the relay which then becomes energized and attracts the armature, thereby switching the line from the line signal to the answering jack.

The application of the differentially-wound relay is an ingenious idea and certainly obviates the employment of the cut-off relay and switch. Whether this system gives a well-balanced talking circuit is not quite so clear, while a separable and normally open contact between the answering jack and the line is a feature of the system that might be objectionable in practice.

Mr. Charles H. North, assignor to the North Electric Company, of Cleveland, patents a switchboard system having for its object to cheapen and simplify telephone exchange systems and to render them more efficient in service. He obviates the necessity of using condensers or repeating coils in the subscribers' lines, placing a repeating coil simply in each operator's cord circuit, which are about one-tenth as numerous as subscribers' lines.

Referring to the diagram, Fig. 3 shows a complete installation with calling and supervisory signals, the operator's circuit being shown in detail. The line and supervisory signals are shown as gravity drops and are understood to illustrate any approved form of electrically-operated signal. In the diagram station A^1 has called station A^2, and the operator is ringing A^2. When the calling station removes the receiver, circuit is made through the battery H and line signal F^1, and the signal is displayed. The answering plug being inserted, circuit through F^1 is broken, the jacks being of the "five-point" variety, and F^1 is restored. Test current is put on to the bushing of the jack by the sleeve of the plug connected to test battery T by line K 9. With the plug inserted circuit is made through the metallic circuit line, the station and the half l of the repeating coil L. The other half of the repeating coil l^1 is connected to the combined ringing and listening key N, which normally connects l^1 with the tip and ring of plug J^1 connecting the called subscriber. The key N rings station A^2 by throwing in generator Q, the circuit being easily traced between grounds G^2 and G of station A^2. Until A^2 takes his receiver off the hook the supervisory signal F^2 is energized, line B^1 being grounded through the bell a, and making circuit through F^2 and the battery H to ground at G^1, by means of the connection at the neutral point of the winding l^1 of the repeating coil leading to F^2 by means of line m^1 and springs P^3 P^4 of key N.

When the receiver is off the hook connection with ground G is broken and the supervisory signal is de-energized. Supervisory signal F^2 acts in the same way for station A^1, being inert when the receiver is off the hook and active when it is on, circuit then being made

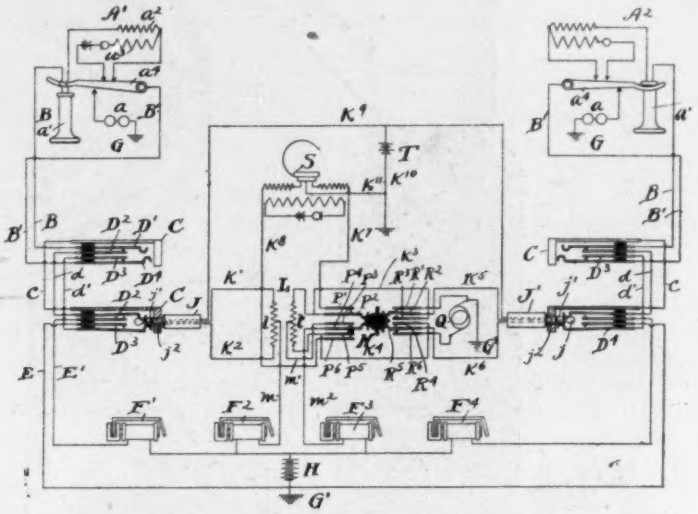


FIG. 3.—NORTH SWITCHBOARD SYSTEM.

from the ground G on bell a through line B^1 and one-half the coil l through F^2 and H to the ground G^1. It is to be noted that although battery H is referred to in the specifications as the "main" battery and station A^2 is shown without local battery, the system is not a common battery system; in fact, as described, battery H is cut off from the line as soon as a plug is inserted in a jack, and thereafter serves only to work the supervisory signals over one leg of the metallic circuit put to ground. The battery H, is in fact, a signaling battery, and does not obviate the necessity of a battery at the subscriber's station. The omission in the case of station A^2 is probably merely a draughtsman's error.

Long-Distance Transmission Into Chicago.

Contracts have recently been closed for apparatus to supply the centrifugal pumps at Bridgeport in Chicago (which pump water from the Chicago River into the Illinois-Michigan Canal), with electric power generated in the power house of the Economy Electric Light & Power Company, of Joliet, 35 miles distant. These pumps have always heretofore been operated by marine engines of high economy, and it is a significant fact that the Economy Electric Light & Power Company could afford to make a figure for supplying power for these pumps lower than steam power. The power house at Joliet is operated by water power. The Economy Electric Light & Power Company will build the transmission line on the banks of the canal from Joliet to Chicago. The Illinois and Michigan Canal Commissioners have contracted for two 300-hp, three-phase motors,

which will be belted to the centrifugal pumps. These motors will be wound for a pressure of 2080 volts. The transmission voltage will be either 30,000 or 40,000 volts, the transformers being arranged for either voltage.

Carbon Bisulphide in the Electric Furnace.

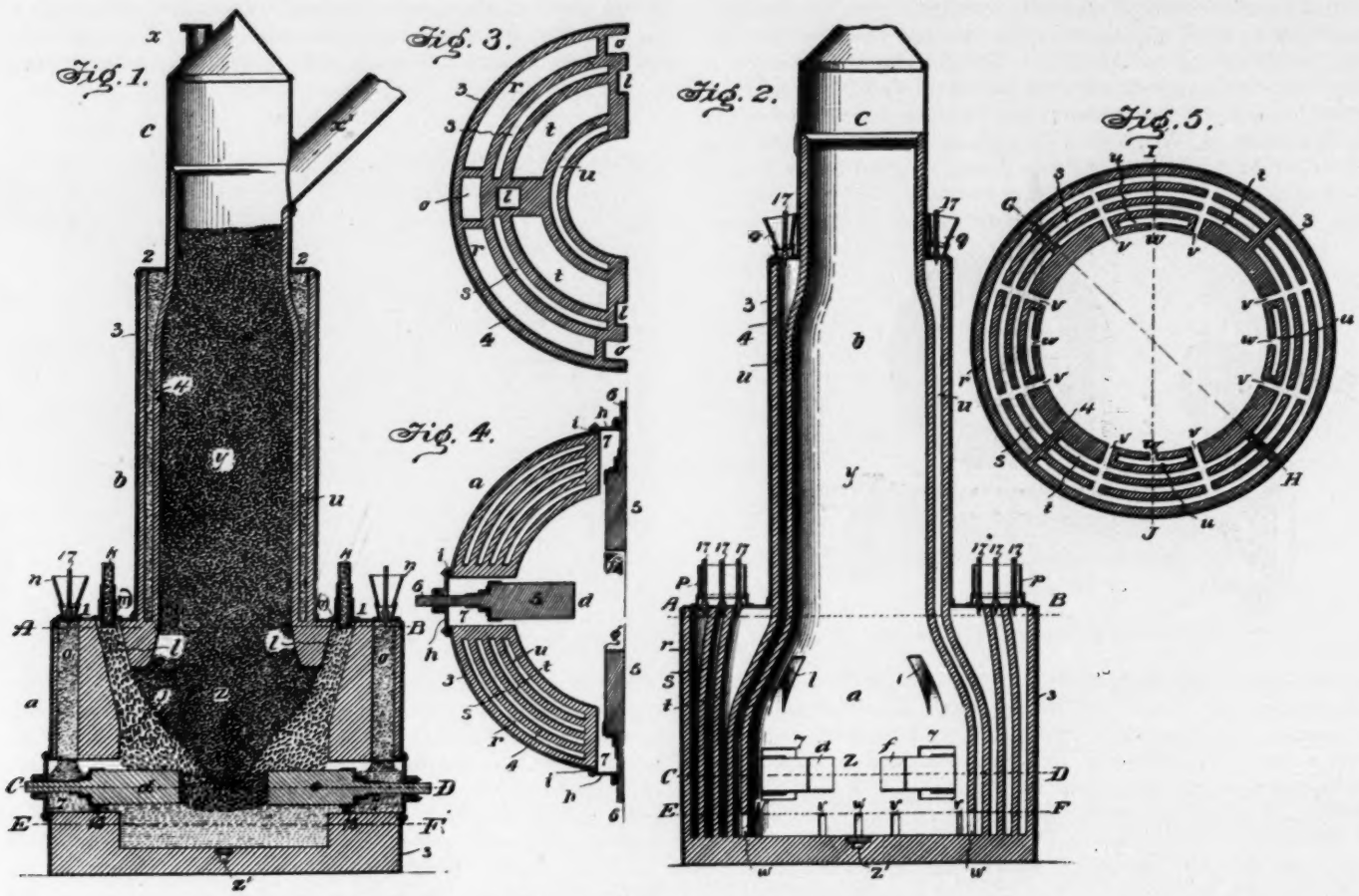
An electric furnace recently patented to Edward R. Taylor, of Penn Yan, N. Y., is of especial interest, not only as showing the details of a structure which has stood the test of prolonged commercial use, but as illustrating a fact, which is becoming yearly more and more apparent—that the field of the electric furnace is by no means to be restricted to the performance of reactions which require excessive temperatures, but that under well chosen conditions many chemical decompositions which lie within the temperature range of combustion funaces may be more effectively and economically brought to pass by heat electrically developed within the reacting mass. The furnace presents a decided novelty, and has been in operation near Penn Yan for two years, producing carbon bisulphide by direct reaction between vapors of sulphur and carbon. It is understood that the output has reached 100,000 lbs. per month, and that after two years of continuous operation the furnace remains in efficient working order.

Figs. 1 and 2 of the accompanying drawings show the structure in vertical section, upon planes 45 degs. apart, and indicated by the lines *GH* and *IJ* of Fig. 5. Figs. 3, 4 and 5 are horizontal sections on planes *AB*, *CD* and *EF*, respectively, of Fig. 1. The furnace is of the stack type, comprising a base, *a*, body, *b*, and dome, *c*. The carbon electrodes, *d*, *e*, *f*, *g*, supported by blocks 15, are arranged horizontally in pairs in the base of the structure, and above them are suitable ports for the introduction of the charge materials—in this case sulphur fed through hoppers *n* to passages *o*, and charcoal *z*, held in bulk in the main shaft *y*. The walls *b*, 4, are double in the intermediate or body portion, and into the interstitial space, *u*, sulphur is also fed by a hopper *q* to absorb and re-convey into the furnace heat which would otherwise be lost by radiation. The lower section *a* is provided with a series of concentric walls, shown as five in number, thus forming four concentric passages, *r*, *s*, *t*, *u*, the innermost of which is continuous with the annular passage, *u*, of the body portion of the stack. All of these passages open at the bottom by ducts, *v*, *w*, into the hearth of the furnace, and through all of them sulphur is fed by hoppers *p*. A sheet iron dome, *c*, continuous with the metal sheathing 3 of the furnace body, surmounts the structure, and is provided with a charging opening *x* and a pipe x^1 leading to a condenser for the bisulphide.

Upon the lower shoulder 1 of the furnace, and adjacent to the hoppers *n* for the introduction of sulphur, are four metal tubes, *k*, attached to but insulated from the sheathing 3. These conduits are situated respectively above the electrodes, and open into downwardly extending passages *l* within the masonry of the furnace base: through them conductive carbon *j* is fed upon and past the electrodes, and serves to protect them from excessive wear and also to close the circuit between them. It is in this bed of fragmentary carbon that the heat necessary for the reaction is developed.

The electrodes comprise a working end 5 and a metallic conductor 6: the electrode ports 7 are closed by removable plates, *h*, *i*, which also permit access to the interior of the furnace. At z^1 an outlet is shown through which the sulphur may be tapped. All hoppers are fitted with regulating plugs 17.

Complicated as the structure may appear, the operation is extremely simple. Sulphur is introduced into the base of the furnace to partially cover the electrode faces, and the several concentric passages between the walls are filled with the same material. Fragmentary coke or other conductive carbon is fed through the pipes *k* to cover and connect the electrodes, and the shaft is filled with the charge of charcoal. The circuit is now closed through the fragments *j*, whereupon the sulphur is vaporized and so reacts upon the charcoal, the resulting bisulphide escaping to the condensers. It will be seen that a double means of regulation is afforded, the current being governed either by the amount of conductive carbon introduced or by reducing the working surface of the electrodes by partially submerging them in the molten sulphur, and also that the waste heat of the furnace walls and of the electrode connections is utilized for liquifying the sulphur. In structure and function alike the furnace is distinctly novel, and its satisfactory operation during a long period bears witness to the care with which the details of construction have been worked out.



Figs. 1, 2, 3, 4 and 5.—Sections and Plans of Electric Furnace.

A Third-Rail Road Across New Jersey.

The projectors of the Trenton & New Brunswick Traction Company, which was incorporated last week at Trenton, have announced that an electric third-rail system will be constructed between these two cities at once. The line will be built entirely over private land, the right of way having been bought for the entire distance. After the line is built to New Brunswick it will be continued straight across the State to near Carteret, and thence across the Kill Von Kull to Staten Island, ending at Stapleton. There a ferry will continue the journey to New York.

In addition to the passenger service, it is proposed to operate a full freight service, first by steam and later by electric locomotives. It is difficult to ascertain the exact backing of the enterprise. If the New Jersey Central Railroad Company is behind it, it could get a line across the State to Trenton by buying up the Raritan River Railroad, which it is now said to control.

It is reported also that the scheme is backed by a syndicate interested in the Newark and Philadelphia trolley lines. The fact that the route goes through few or no important villages or towns lends support to the belief that a new fast route between New York and Philadelphia is projected. It is impossible to get the greatest speed on the present lines because of the large towns which are intersected.

It is the intention of the promoters of the new line to use standard passenger coaches of 60 or 66 ft. in length, and weighing upward of 100,000 lbs. complete. The cars will have four motors and will be run at a speed of 75 to 80 miles per hour. It is expected that from New Brunswick the line will be run straight through to near Carteret, and there cross the Kill Von Kull to Staten Island, ending at Stapleton. A ferry will continue the journey to New York City.

CURRENT NEWS AND NOTES.

ELECTRIC LIGHTING IN CANADA.—The Dominion statistican, in his annual report on the use of electricity in Canada, finds that the number of companies doing business in electric lighting is 306, against 259 in 1898. The arc lights, supplied from central stations, increased in this time from 10,389 to 12,800, and the use of incandescent lamps from 463,615 to 815,676. Assuming that an arc light is equal to 10 incandescent lamps, this means that the business has grown to the extent of over 66 per cent in the three years.

ALLEGED THEFT OF CURRENT.—The chief engineer of one of the uptown restaurants in New York was arrested last week and taken to the Tenderloin Police Station on the charge of having stolen some electric current. The complainant in the case was an inspector of the Edison Electric Company, who claimed to have found that one of the wires of that concern was tapped and in use for the purpose of furnishing power to the place. The man was bailed out by the manager of the restaurant, who said that the arrest was one of spite, as the wires of the Edison Company were formerly used to furnish the electricity, but of late had been disconnected, as the place had its own plant for electric light and power.

CALIFORNIA TRANSMISSION PLANT.—The Keswick Electric Power Company's new electric power transmission plant was recently put into operation, and is now successfully transmitting current to Redding, Calif., the distance being 29 miles. The water-power generating plant is located on Mill Seat Creek in the Shingletown district. The company will also supply electric power for the Mountain Copper Company's smelting plant at Keswick, distance 34 miles from the plant, and for the Iron Mountain mine, 14 miles beyond Keswick. The company is preparing to light the town of Keswick, and an extension of 27 miles to Red Bluff is projected. It is also proposed to extend the system to Corning.

ALTERNATING-CURRENT MOTOR.—A patent was issued Dec. 10 to Ernest Wilson, of the County of Kent, England, on an application field Jan. 17, 1893, on an alternating-current motor. The motor is for polyphase currents, and as illustrated is connected to a two-phase circuit. The stator winding is of the usual type, being a distributed winding, two diametrically opposite points of which are connected to one leg of the two-phase circuit and two other points 90 degs. distant connected to the other leg. The rotor has a commutator with four brushes. Two diametrically opposite brushes are connected across one leg and the other two brushes 90 degs. distant, connected across the other leg. If the brush carrier is so moved that points of the brush contacts are in axial planes passing through the points of stator connection with the circuit, there is no motion; if the brushes are moved to the right, there is motion in one direction, and if moved to the left, there is motion in the other direction. A maximum speed is obtained when the brushes are moved through an angle of 45 degs. with respect to the neutral point.

KENNEDY WATTMETER.—A patent granted Dec. 10 to Rankin Kennedy, Leeds, England, describes a wattmeter, the principle of which is that of a balanced dynamometer. The shunt coil is movable, surrounds the series coil and is mounted on one end of a balance beam; at the other end of the beam is an arrangement for producing a fluid resistance. This latter arrangement consists of an air holder hung at one end of the balance beam with its mouth dipping into a fluid so as to be sealed thereby; a very fine tube communicates with the interior of the air holder at one end, and is open to the air outside the container at the other end. In action whenever the dynamometer affects the beam the air holder is either sunk lower into the fluid or lifted upward in it at a rate proportional to the flow of air through the fine tube. The fluid resistance acts in opposition to the dynamometer side with a force proportional to that of the dynamometer; hence the number of oscillations of the balance beam in a given time is directly proportionate to the amount of electrical energy passed during that time. The current in the shunt coil is, of course, reversed at the extremity of each oscillation of the beam.

THE ZOSSEN EXPERIMENTS.—Consul-General Mason, of Berlin, reports during the first few days of the Zossen experiments the speed attained was 55.9 miles per hour. This was gradually increased until the record of Nov. 9 showed a pace of 150 kilometers (93.2 miles) per hour. Mr. Mason states that above that velocity the increasing danger of derailment and the tremendous strain upon track and rolling stock would, it is believed, outweigh the advantages of higher speed with the machinery now available. It is, therefore, understood that the experiments are suspended, at least until some radical changes, suggested by this experience, may be made in the construction of motors and other details of the apparatus. He adds that the official report, when it shall appear, will be replete with new and interesting data for electrical scientists. The motors, although in at least one instance "burnt out" by the powerful current, have apparently done all that was expected of them, and the expected difficulty of "getting the current into the car" from a triple overhead wire seems to have been successfully overcome. The other anticipated obstacle—air resistance—proved less serious than was expected. The maximum pressure registered by the instruments placed in front of the cars was 134 kilograms per square meter—approximately, 16.7 lbs. per sq. ft.

A HIGH COMPLIMENT.—The editor of the Latin journal, *Praeco Latinus,* published in Philadelphia, some years ago obtained the collaboration of a number of eminent scholars throughout the world toward the translation of Thomas a'Kempis from the schoolman's Latin, in which it was written, into the language of the Roman age of Augustus. This work was recently completed, and among the several editions of the book is an elegantly printed edition de luxe of 100 copies for presentation, which includes printed lists of those thus complimented, and an engraved frontispiece for the inscription of the name and qualities of the recipient. The list includes the great Latin authorities of the world, the Pope, the heads of the Anglican Church, the upper hierarchy of the Catholic and Episcopal Church of this country, and some of the European crowned heads who have shown an interest in Latin learning. Among the few names not in the above categories is that of an electrical engineer, Mr. C. O. Mailloux, who has been added to the list in recognition of his constant contributions to the columns of the *Praeco Latinus* since its foundation in 1894. The notice thus conveyed of Mr. Mailloux's accomplishments in Latin will be a surprise to some of his friends, many of whom are also unaware that he speaks fluently all of the principal European languages. The pages of this journal have indeed been graced by several technical translations made by him from electrical journals published in all the civilized tongues.

FRANKLIN INSTITUTE MEETING.—Mr. Paul M. Lincoln, electrical engineer of the Niagara Falls Power Company, will read a paper before the Franklin Institute, Philadelphia, Dec. 19, on "The Parallel Operation of Alternating-Current Generators."

NEW ATLANTIC CABLE.—The cable steamer "Faraday" has just finished laying a cable between the Azores Islands and Ireland for the Commercial Cable Company. This completes the fourth cable of that company between the United States and England.

TELEGRAPHY IN KOREA.—A dispatch received at Yokohama from Seul, Korea, says that the Russian Minister there declares that he is determined to insist on the construction of a Russian telegraph line from Possiet Bay to Seul, contending that the Emperor of Korea has no right to withdraw his consent, which was previously given.

U. S. PATENT CLASSIFICATION.—We note that the United States Patent Office has lately made the following changes in classification: In Division 16, sub-classes are established as follows: In Class 176, electric lighting, lights, incandescent; 317, second-class conductors; 318, vapor conductors. These refer apparently to lamps of the Nernst and Cooper-Hewitt types. Class 178, telegraphy; 319, wireless telegraphs. We note also sub-classes under warp stop motions as follows: 91, electrical; 92, mechanical.

BILL TO BUY TELEGRAPH LINES.—Representative Jackson (Dem., Kan.) has introduced a bill in the House providing that the United States Government purchase the Western Union and the Postal Telegraph companies, and thereafter operate them in connection with the Post Office Department. Provision is made for appraisal of the property of the companies and for the payment of its appraised value when the amount is reported to Congress.

TELEPHONY IN OHIO.—It is stated that telephony will figure in the legislative fights and manœuvres in Ohio this winter. Independent telephones are now operating over some of the private rights of ways of various interurban roads, coming towards Cincinnati along the Miami & Erie Canal, which is now controlled by the Everett-Moore syndicate. Consolidation of all companies is talked of, but the most popular idea is to compel, through the legislature, an exchange of message system, similar to that now in vogue by the different telegraph companies.

LONDON & NORTHWESTERN.—A cable dispatch from London of Dec. 14 says: The question of electrifying the entire system is now engaging the attention of the officials of the London & Northwestern Railway, the greatest railroad in the United Kingdom. The matter seems to have reached such an advanced stage as to justify its mention in the financial columns. The *Globe* says that the directors and the experts who were summoned for consultation are reported to have formed the opinion that, if electrified, the road could considerably accelerate and cheapen its service.

DAMAGE BY FLOODS.—Heavy rains on Saturday night last caused floods which wrought heavy damage to railroad, telephone, telegraph, electric light and electric railway property in various places in Central New York and Eastern Pennsylvania. In Ithaca, N. Y., the street railway car barns were carried away and the electric light and gas plants were flooded, thus depriving the city of light. Port Jervis was in total darkness in consequence of the flooding of the electric light station, and in many other places like conditions existed. The floods were of great severity, and the trunk line railways running through the sections visited by the heavy rains were badly washed out and otherwise damaged in many places.

FRISCO BAY LIGHTS.—The recent ferryboat disaster in San Francisco bay, when lives were lost during a collision, has led to a search for some device that will aid navigation on the bay during thick fogs. President Kilburn, of the Harbor Commission, has instructed Electrician Whorf, of the Board of Experiment, to experiment with different colored lights and effects on the tower of the ferry building. The electrician named finds that green electric lights have greater penetrating power in the dense white fogs peculiar to the bay than either red or white lights. Powerful searchlights with different colored disks will be used at night during foggy weather, and reports on the efficiency of the lights will be received from masters of the ferryboats.

AUTOMOBILISM IN FRANCE.—A dispatch from Paris states that the government refuses to authorize automobile races during the Grande Semaine at Nice, in April. The mayor of Nice was officially advised to that effect. All mayors of communes and prefects of departments on the route of the big races had given their consent, so the government's decision creates surprise. The fourth annual automobile exposition under the auspices of the Automobile Club de France has been opened in the Grand Palais. President Loubet assisted personally at the inauguration. A typical feature of 1902 is the Limousine style of automobile, the body being all enclosed. The occupant is thus sheltered from dust, and the idea of comfort is being enlarged upon.

ELECTRICAL SMOKE DETECTOR.—A patent issued Dec. 10 to O. Freymann and Charles Tolman describes an electrical smoke detector alarm, which depends for its principle upon the peculiar action of smoke on a fiber which has been subjected to a certain treatment. The fiber, which may be of silk or a horse hair, is boiled in a closed vessel for about 20 minutes in a 6 to 10 per cent solution of commercial soda then dried while very moderately stretched in a tube from which the air is exhausted. The inventors state that they are unable to precisely explain what transformation is produced in the fiber by treating it as above described, but it is found that when smoke comes in contact with fiber so treated an elongation invariably results. This elongation is made to close an electrical alarm circuit.

POSTAL SERVICE.—In his annual report Postmaster-General Smith recommends the restoration of the pneumatic tube system in New York, Philadelphia, Boston and other cities. Of automobile mail carrying the report says: "The first contract for the carriage of mails by automobiles was entered into during the last fiscal year for service between the Post Office at Buffalo and the station in the Pan-American Exposition grounds, a distance of 4¼ miles. This distance was covered in 35 minutes, and there were seven trips daily. The service rendered proved satisfactory, and a contract will go into effect on Jan. 1, 1902, for similar service in Minneapolis, which will afford a still better test of the adaptability of the automobile for service in large cities." The Buffalo service was done with electric vehicles.

M'KINLEY MEMORIAL.—Colonel Allan C. Bakewell, of the Sprague Electric Company, representative of the electrical industry for the McKinley Memorial Association, has received and gives out the following letter from Mr. Cornelius N. Bliss: A happy solution of the confusion resulting from two associations appealing for popular subscriptions at the same time for the McKinley Memorial was arrived at by a conference held in Washington, Dec. 7, between committees of the McKinley National Memorial Association and the Washington Memorial Arch Association. The latter decided to withdraw its application for popular subscriptions, leaving that field entirely to the National Association to make provision for the memorial at Canton, and it was mutually concluded to ask Congress to make such provision for a memorial at Washington as should be thought fit and proper by that body. This leaves the field of popular subscription entirely free for the Association with which you are connected, and we trust that prompt and active measures may be taken by all the committees of this association to conclude the work in this State at the earliest possible moment.

RÖNTGEN RAY APPARATUS.—A patent issued Dec. 10 to E. W. Caldwell, New York, describes a Röntgen ray apparatus especially adapted to give stereoscopic images in a fluoroscope. The Röntgen ray tube is a double focus tube, in which the foci are separated to give alternately radiation from two separate points. The fluoroscope is provided with a shutter, which, by means of the equivalent of a polyphase motor contained within the fluoroscope, is caused to rotate synchronously with the emission of Röntgen rays from the electrodes of the tube. Two slight holes in the fluoroscope are alternately closed and opened by the revolving shutter. The image of an object produced by the rays from one of the tube electrodes is seen through one of the holes, and the image produced by the rays from the other electrode is seen through the other hole. The simultaneous effect of the vision of the two images, therefore, gives a stereoscopic image at the place occupied by the object, and the rapid succession of the images produces a blending so that the effect produced is that of continuous vision by each eye of the image seen by that eye, thus approaching very closely normal binocular vision of an object in its proper shape and space relation.

ELECTRIC LIGHT IN SURGERY.—The *Medicinische Woche*, of Vienna, publishes an article by a celebrated Russian surgeon on the use of the violet electric light as an anæsthetic for surface operations, such as the sewing of wounds. He says that the rays have also a healing influence on wounds, burns, sores and skin diseases.

AUTOMOBILE SHOW IN PARIS.—President Loubet, accompanied by the Minister of Commerce, M. Millerand, opened the fourth annual Automobile Exposition at the Grand Palais on Dec. 10. The vast hall was packed with spectators. All the auotmobile firms were represented by tastefully decorated stands. An attractive feature of the show is Tatin's dirigible balloon, built for M. Deutsch, which hangs from the roof, like a huge yellow cigar, in the portion of the hall reserved for exhibits relating to steering balloons. No revolutionary innovation in automobiling is exhibited. The two noteworthy features were the increased lightness and simplicity of the frames and the more luxurious and artistic carriage work. Industrial automobiles are quite a feature.

BRITISH TELEGRAPHS CRIPPLED.—The storm which prevailed in Great Britain last week, has caused a telegraphic breakdown unequaled since 1881. The North was practically cut off from the South, and many of the provincial towns were so snowbound that the courts were closed owing to the litigants residing in the country being unable to reach them. Difficulty was experienced by New York people in communicating with points in the United Kingdom by cable. At the offices of the Anglo-American Telegraph Company it was said that the cables were working satisfactorily, but that the severe storms that had swept the British Isles had severely crippled the telegraph system on the other side. Similar statements were made by officials of the other cable companies. The Commercial Cable Company had open communication with London, but was cut off from other points of importance in the kingdom. Messages to some English points were forwarded by cable with instructions to send them on to their destination by the first mail trains.

LETTERS TO THE EDITORS.

Alternating Current Terminology.

To the Editors of Electrical World and Engineer:

Sirs.—I have been much interested by the editorial in your issue of Nov. 16 and the Digest reference, Nov. 30, page 902, on alternating-current terminology, and hope they will start a discussion and lead to the selection of a suitable term to designate the quadrature components "*I* sin ϕ" and "*EI* sin ϕ." The terms "wattless current" and "wattless e. m. f." are in general use. We have also seen "wattless resistance" and "wattless impedance"[1] used without criticism. And to be consistent, we now have "wattless power."[2]

When it became necessary to speak of the amount of this power, for a power it certainly is, one is forced to use the unit of power and write "wattless watts," however absurd it may seem. The term "wattless volt-amperes" has been used, but the volt-ampere is usually an imaginary quantity, and does not seem suitable here. Neither does the suggestion of the editor of *L'Industrie Electrique* seems to be a happy one. The effect of his "fictive power" is anything but a fiction. M. Boucherot suggests "magnetizing current" and "magnetizing power," which is certainly better, but again confusion is likely to arise when used with reference to condensers. Possibly "reactive current" and "reactive power" might be acceptable.

I should be glad to see the opinions of others upon this subject, and hope we may soon come to some definite understanding.

UNIVERSITY OF ILLINOIS. WM. HAND BROWNE, JR.

To the Editors of Electrical World and Engineer:

Sirs.—I am ordinarily an inveterate enemy of new terms in electrical engineering, feeling that the nomenclature of the art is already overburdened with names and units of no conceivable use save in economizing the time of a few *doctrinaires* to the extent of perhaps 50 words a month. It were better that they should write less and in plain English words. But just now comes to the front *L'Industrie Electrique* with two new and dreadful suggestions, which have in them, nevertheless, a nucleus of reason. The volt-amperes in quadrature in an alternating circuit certainly deserves a better name than wattless power, which is self-contradictory, or fictitious power, which is little better. It is a little difficult to understand, however, why a special name and particularly a name so laborious as "factor of impotence" should be needed to express so simple and commonplace a function as sin ϕ. It is perhaps somewhat unfortunate that the term lag factor should have been made to serve for cos ϕ instead of sin ϕ, but such has been its fate and we must make the best of it.

The working engineer would certainly find a simple expression for the numerical difference between apparent and true watts of some practical utility. At present we have for this quantity only circumlocutions or purely mathematical statements. Likewise, there is no general term for the difference between the power factor and unity. It seems to me that before terms are devised for other things, that common quantities *versin* ϕ and *E I versin* ϕ need attention. The former, as just written, is, in fact, amply competent for the occasional service required for it. I do not see why we should not write or speak as freely as of *sin* ϕ and *versin* ϕ as of cos ϕ. Those to whom these trigonometrical functions have not sufficient significance had better keep away from alternating-current phenomena. As for the numerical difference between volt-amperes and watts, why not speak of it as *dephasement* and reckon it in volt-amperes? This would be sufficiently brief and descriptive, and a term for the thing is in some measure needed. Logically, one might go a step further and call the difference between power factor and unity the *dephasement factor*, if anything more than *versin* ϕ should prove to be desirable. At all events, the whole matter of names for functions of ϕ is up for consideration, and should be overhauled carefully before anything so weird as "factor of impotence" gets permanently fastened upon our working vocabulary.

BROOKLINE, MASS. LOUIS BELL.

[1] *Transactions* A. I. E. E., Vol. 9, p. 258, *et seq.*
[2] *Transactions* A. I. E. E., Vol. 16, p. 291.

Long-Distance Transmission in Canada.

To the Editors of Electrical World and Engineer:

Sirs.—The ELECTRICAL WORLD AND ENGINEER is a constant visitor at my office, and I don't know of any paper in my list that I as willingly give up my money for, but I do feel very touchy when you slight or forget your neighbors across the border as easily as you seem to have done in your issue of Nov. 30. On page 879 you speak of long-distance transmission in California and of the difficulties they have had to overcome, all of which I read with a great deal of interest. Your remark with reference to the reason why California is the center of these long-distance transmission plants in so far as the fuel question is concerned no doubt is true, but I do not agree with you about the climatic conditions existing there being better for the employment of high electric pressure than in western New York. However, that is another story, and one which I hope to deal with later on.

The sting in your editorial is in the last words of the second paragraph, where you state, "Niagara transmission halts at 20 miles." This would be the inference that the price of fuel and the climatic conditions are such that it is not commercially practicable to transmit current in the Niagara district profitably a longer distance than 20 miles. The Hamilton Electric Light & Cataract Power Company are transmitting power from De Cew Falls, which is Niagara water taken out of the Lake Erie level of the Welland Canal and used on the Niagara escarpment about eight miles from Niagara Falls, and two miles south of the city of St. Catharines, where a fall of 270 ft. is obtained. The power house is situated there, and has a capacity of 8000 hp, and the current is transmitted 37 miles at 22,500 volts to the city of Hamilton, where it is employed in operating two suburban street railway lines and one city railway, with an aggregate mileage of about 50 miles, as well as a number of large cotton mills and other power consuming industries, besides furnishing arc and incandescent lighting used in the city of Hamilton, which has a population of about 60,000 people. The longest distance at which the primary current is used from the power house is at Burlington Beach, approximately 42 miles.

That the transmission of power this distance at that pressure has been successful is best evidenced by the fact that it has been in successful operation since August, 1898, and that we have not used any steam since that date for any trouble due to the electrical generating machinery or the transmission line. The company has from its very inception paid a dividend and interest on a capitalization of $5,000,000, which speaks for itself, and I think proves conclusively

that it is not a *"sine qua non"* that the price of fuel or the climatic conditions as they exist in California are necessary for the long-distance transmission of power commercially.

Toronto, Canada. J. A. Kammerer.

U. S. Signal Corps Telephones.

To the Editors of Electrical World and Engineer:

Sirs.—In answer to the letter of Mr. W. M. Lannan, published in No. 23 of Electrical World and Engineer, I would state that Mr. Lannan is evidently very poorly informed as to the types of telephones in use by the United States Signal Corps.

The Signal Corps uses many types of telephones, each one being specially adapted for the various purposes for which it is to be used. Type "E" kit, the telephone that is usually used in the field, instead of being like the one used by the National Guards and State Militia, is a combination telegraph and telephone set, enclosed in a leather case, about the size of a 3 by 4 camera, with a sling strap, and weighs not more than 5 lbs. I trust this will give Mr. Lannan some information regarding the portable telephone in use by the Signal Corps.

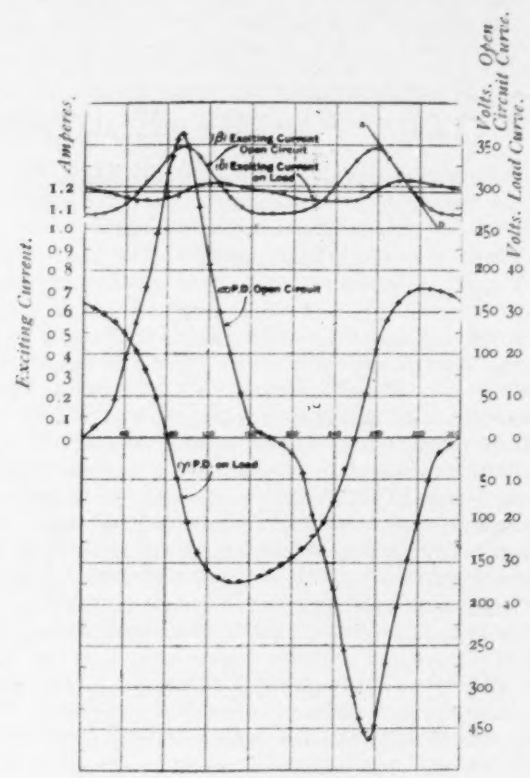
Fort Myer, Va. Thomas J. Stewart.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers

Properties of Commutators.—Heyland.—A reply to the criticism of Leblanc, noticed recently in the Digest. He agrees that Leblanc's criticism would apply, if an ordinary commutator would be used. But he uses a closed ring, or a commutator, the segments of which are connected together by resistances. He shows that this modification is important, as Leblanc's criticism breaks down on account of it. In a foot note he gives a brief report on his first successful experiments with his new induction motor, as noticed in the Digest last week. In an editorial note a brief review is given of the question at issue. About a year ago Latour suggested this problem: Let three-phase currents be supplied to a direct-current dynamo armature by means of three brushes, properly arranged; if the ring and the brushes are fixed, a magnetic field is produced which revolves in a certain sense with a speed s, and to produce it the currents have to overcome the impedance of the circuits. If the ring revolves in the direction of the rotation of the field with the speed s and the brushes are fixed, or if the ring is fixed and the brushes revolve with the same speed in the opposite direction, the field will be fixed relatively to the ring and its circuits no longer cut any line of magnetic induction, and, therefore, do not oppose to the passage of the currents any other resistance than the ohmic resistance. The argument in this form seemed correct. In view of the practical importance of the question of the construction of self-exciting alternators, and induction motors with a power factor equal to unity (Digest, Aug. 31, Nov. 30; Electrical World and Engineer, Sept. 28, page 492), the problem was closely investigated by various authors. It was especially important to investigate whether the complex phenomena of commutation which are not taken into account in the above argument, would not modify the conclusion. In regard to this point, different persons who have investigated it, differ in their opinion. Leblanc concluded that it is impossible to eliminate the impedance of the circuits by means of rotation of the ring or the brushes (Digest, Nov. 23, where there is abstracted a similar paper by Bunet also; see also Electrical World and Engineer, Nov. 23, page 843). Latour, however, maintained his position and supported it by a theoretical investigation and by experiments made by him and Boucherot, which show that the impedance is a function of the speed of rotation (Digest, Dec. 14). Heyland admits the correctness of Leblanc's criticism for an ordinary commutator, but not for a commutator, the segments of which are connected together by resistance. Heyland's first successful experiments with his motor prove the correctness of his argument. While experiment thus seems to have decided in favor of Latour's and Heyland's arguments, the question is not quite clear theoretically.—*L'Eclairage Elec.*, Nov. 30.

Periodic Variations in the Exciting Current of an Induction Alternator.—Duddell and Marchant.—The first part of an illustrated article. When the rotation of the moving parts of a dynamo causes variations in the reluctance of the magnetic circuit which forms its field, an alternating e. m. f. will be induced in the field coils if the machine is excited. This alternating e. m. f. produces an alternating current in the field circuit and as a result the exciting current of the machine may be considered to consist of two parts, namely, the normal constant exciting current and an added alternating current induced in the field circuit by the machine itself. They first give the theory for the machine at open circuit. The alternating e. m. f. induced in the field coils has twice the frequency of the armature e. m. f. The added current sent through the field circuit by this alternating e. m. f. will, owing to the large time constant which the field coils usually have, and to the relatively high frequency, lag behind the e. m. f. and have its maximum value approximately when the e. m. f. is zero, and be zero when the e. m. f. is a maximum, and the amplitude will be determined by the self-induction rather than the resistance of the field circuit. If the magnetic circuit is approaching saturation, the self-induction of the field coil will vary with the direction of the added current, being smaller when the added current



WAVE FORMS OF INDUCTION ALTERNATOR.

increases the exciting current of the machine than when it decreases it; so that even if the e. m. f. wave induced in the field coil is symmetrical about its zero line (which is not necessarily the case if eddy currents and hysteresis are taken into account), the added current due to it will not be so, but will be larger in the direction in which the self-induction is less. Thus the added current should tend to increase the exciting current more than it decreases it, and two consecutive half periods of the added current will not be equal in length. If it is assumed as a first approximation that change of exciting current of the alternator only changes the magnitude and not the relative distribution of the lines of force through the magnetic circuit and inductors, the e. m. f. induced in the field coil will bear the same ratio to that induced in the armature for every excitation. There-

fore, the maximum amplitude of the field coil e. m. f. wave will bear a constant ratio to the maximum amplitude of the armature e. m. f. wave. They have investigated experimentally the wave form of p. d. and current in the armature and the variation of the exciting current of a 6-kw inductor alternator; the resistance of the armature is 0.4 ohm, the self-induction of the armature between 0.009 and 0.012 henry, depending on the position of the inductors; the resistance of the field coil varies with the excitation the frequency of the testing current and the position of the inductor, and is 1.08 henrys at 190 p. p. s. and no excitation. The armature reaction in this alternator is very large. The accompanying diagram gives the results of a test in which the frequency was 95, and the mean value of the exciting current 1.175 amperes. The machine was tested at open circuit and on non-induction load. The two upper curves give the exciting current for the two cases, the lower two curves the curve of the p. d. between armature terminals. It will be seen that the total variation in the exciting current at open circuit is considerable, being 27 per cent of the mean value; the frequency of the variation is double that of the armature e. m. f.; the wave form is not symmetrical about the mean line of the exciting current. The paper is to be concluded.—Lond. *Elec.*, Nov. 29.

Measuring the Slip of Induction Motors.—SCHWEITZER.—An article on a method of measuring the slip of an induction motor by means of the stroboscopic method with the aid of Braun's cathode ray tube. Zenneck has shown that this tube can be used for determining the variations of the frequency of an alternating current in a very simple way. The induction coil by which the tube is lighted, is provided with an interrupter so that a certain number of discharges per second are sent through the tube. The cathode ray tube is placed in a rotary magnetic field, produced by the alternating current to be tested. The axle of the cathode ray tube is perpendicular to the plane of the rotary field. If the frequency at which the interrupter is operated is equal to the frequency of the alternating current or to a multiple of it, the screen of the cathode ray tube shows one or several luminous points at rest. When the frequency changes, these luminous points rotate in a circle. They complete a full rotation for a change of the frequency by ± 1. This method can, with some modifications, be applied to the measurement of the slip of an induction motor. For this purpose, the rotary field is produced by the alternating current which feeds the motor, and the interruptions of the inductive coil are made by a revolving interrupter directly driven from the motor. The test consists in the measurement of the number N of revolutions which the motor makes during a certain number Z of total revolutions of the luminous point. The slip is then given by the formula

$$s = \frac{Z}{pN + Z}$$

where p is the number of pairs of poles of the motor. As one can observe up to 6 revolutions of the luminous point per second, it is possible to measure at a frequency of 50 slips up to 12 per cent.—*Elek. Zeit.*, Nov. 14.

Design of Direct-Current Dynamos.—RANKIN KENNEDY.—A brief article in which he says that it is easy to avoid sparking at the commutator. The problem is not so much a scientific question as one of costs. A sparking commutator means a weak magnetic flux and an armature with too many turns of winding, the winding being piled on to make up for want of magnetic flux. He gives the rule that for a bipolar machine the ratio of the total magnetic flux through the armture to the number of turns or bars in the armature winding, should not be below 3. As unit for the induction he takes Kapp lines where 15 Kapp lines per square inch are approximately equal to 14,000 c. g. s. lines per sq. cm. Any value of this ratio below 3 is dangerous in a bipolar machine, hence a good bipolar machine must have a very heavy magnetic circuit and few turns or bars on the armature, and these bars must be multiplied or very heavy, thus introducing air space difficulties. It is, therefore, better to adopt multipolar construction. His rule is then that the ratio of the total flux between any one pair of poles and the number of armature turns or bars between the centers of the two poles, should not be less than 3. At the end of his article he speaks of "the unipolar dynamo in which there is collections, but no commutation. A unipolar dynamo has hitherto been considered as only fit for low pressure and large currents, it being considered impossible to put conductors on the armature coupled in series with each other. But this can be done and a unipolar dynamo made for 500 or 600 volts at, say, reasonable speed. In a unipolar machine the magnetic flux can be easily increased to a very large value. There is no reversal of magnetism, nor of current. No necessity for laminations, and, of course, no commutation. A simple device recently discovered renders this long-sought machine possible. When fully developed and protected, it will be illustrated and described." (We regret that Mr. Kennedy should greatly lessen the value of his article by the use of that still-born absurdity—the Kapp line).—Lond. *Elec. Rev.*, Nov. 29.

Determining Hysteresis and Eddy Current Losses in Dynamos.—STRYMEERSCH.—The methods of Housman and Swinburne for determining the hysteresis and eddy current losses in dynamos and motors, are described, and the necessary precautions are pointed out. The dynamo is run as a motor at various speeds, the excitation being kept constant, the highest speed corresponding to the e. m. f. developed in the dynamo at the load at which the losses are to be measured. Experiment shows that the power lost by eddy currents is proportional to the square of the speed, while hysteresis and frictional losses are directly proportional to the speed. If a curve is plotted with the applied e. m. f. and the current as ordinates, it is a straight line, and this graphical method enables one to find easily the loss due to hysteresis and the loss due to eddy currents. An account of an experiment with a shunt motor is given which illustrates the accuracy of the method.—*Ass. Ing. El. Liege*, July 6; abstracted in *Science Abstracts*, Nov.

REFERENCE.

Extensions of Swinburne's Method of Testing Dynamos and Motors.—BRUNHES.—Swinburne's method of testing dynamos and motors is to run them at no load under the same magnetic conditions as at full load, and hence to find the losses due to friction, hysteresis and eddy currents. The chief cause of error arises from the difference between the mechanical friction in the two cases. In the case of rotary converters and dynamotors the error due to this difference is negligible. Rotary converters can be usefully employed for measuring the power given to transformers, synchronous or asynchronous motors, etc., or for testing alternators.—*Ass. Ing. El. Liege*, July 6; abstracted with some of the formulas in *Science Abstracts*, Nov.

POWER

REFERENCES.

Traveling Crane.—A well illustrated description of a traveling crane made by a British company. It is designed to lift 10 tons, with a span of 40 ft. The hoisting motion was specified to be at the rate of 14 ft. per minute with full load. This motion is driven by a 24-hp motor, running at 1000 revolutions. The cross-traversing motion was specified to be at the rate of 60 ft. per minute, and is driven through spur gearing from 3-hp motor running at 420 revolutions.—Lond. *Elec. Rev.*, Nov. 29.

Electrical Equipment of Cranes.—RUNG.—The conclusion of his long illustrated article. He discusses the brakes. The electric brake alone is not sufficient, and a mechanical friction brake must, as a rule, be added. The ordinary block or band brake are not suitable for this purpose. He finally discusses the general arrangement of supply mains, motors and controlling gears. The article is illustrated throughout with diagrams, showing arrangements and designs used in actual practice, and especially those made by Brown, Boveri & Co.—Lond. *Elec. Rev.*, Nov. 29.

Transverse Stresses in Steam Pipes.—MANN.—The second article on this subject. In the present article the author discusses and gives formulæ for calculating the relative lengths of mains and branches. —*Am. Elec.*, Dec.

Brick Chimneys for Power Stations.—ENNIS.—An illustrated article on the design and construction of brick chimneys for power stations.—*Am. Elec.*, Dec.

Feed-Water Softeners.—An illustrated article describing two British feed-water softeners, and the principles of their operation.—*Am. Elec.*, Dec.

TRACTION.

Milan-Monza Interurban Tramways.—SEMENZA.—This road is about 17 km. in length, and is owned by the same interests as those which operate the city tramways of Milan. Quite a full description is given of the bond used, which is the same as that employed in Milan for the last five years with satisfactory results. Each end of the bond wire is turned up in the form of a small coil, which is brazed to the base of the rail. The poles are made of two U-shaped beams connected with lattice work. Power is obtained from the

hydraulic transmission plant which supplies power to the Milan Edison Company. Current on the transmission line is carried at 15,000 volts, 42 cycles. A storage battery is employed in parallel with the rotaries. The cars have removable upper decks so that they are run as double-deck cars in summer and single-deck cars in winter.—*St. R'y Jour.*, Dec. 7, and Int. Ed., Dec.

A Plea for the Bow Trolley.—E. K. Scott.—While American tramway practice is closely followed all over the world, there is one feature of car equipment, in which the Continent has refused to follow America, and that is in the current-collecting trolley. In Germany the fishing rod trolley pole has almost entirely been replaced by the Siemens bow trolley. He discusses the advantages of the bow trolley over the fishing rod. First, and foremost, it is impossible for the bow trolley to jump the trolley wire. With a bow trolley there is nothing to get loose, there are none of the pins, bolts, etc., which go to make up a trolley head. As the rubbing contact of a bow is entirely on the underside of the wire, the overhead fittings may be very simple, and it is possible to pass over switches and go around corners at a good speed. In changing direction at terminals, the height of a trolley wire can be arranged so that the bow will adjust its rake automatically for the return journey. The turning round of the trolley pole to change the direction is a great nuisance. The experiments in Germany on high-speed traction have shown that the bow is by far the best method of collecting current. It will collect larger amounts of current and admit of much higher speeds than a wheel contact, and the spring of the bow itself appears to present important advantages over the more rigid wheel construction. Another point of interest is that it is quite easy to have two bows on one car, and so break the trolley wire connections at crossings or complicated places in much the same way as an electric railway train is worked. To put two trolley poles on one car would be risky and expensive. In some towns the authorities do not allow trolley wires along some of the main streets, and accumulators are used there. In such cases, it is common practice to have two bows, one to collect current for the motors and the other for the cells.—Lond. *Elec. Eng.*, Nov. 22.

Third-Rail System and Safety.—An editorial on an accident which recently occurred on the Central London R'y, in which a passenger fell from the platform on to the bare third rail. There is always a menace to public safety from a bare third-rail conductor in front of the platform at a passenger station. In passenger stations a timber or other protection should be built around the sides of the conductor, in such a way that it would not interfere with the collection of current by the locomotive, but would prevent any person from touching the conductor if he fell on the track. An even better plan would be to dispense altogether with live conductors on those parts of the track which are immediately in front of platforms. The momentum of an incoming train is always sufficient to carry it the length of the station, and if the locomotive were allowed to advance on to the next section of live conductor before stopping, the restarting would not be interfered with. There is the objection that a train could not be restarted in the event of the locomotive stopping short of the third rail. It could be obviated by having a perfectly isolated section of third rail in the station, and making this "live" either automatically or by a switch in the signal carbin, only at times when a train might actually be in the station.—Lond. *Elec.*, Nov. 29.

A New Type of Rail Bond.—A description of the bond used in Geneva, Switzerland. It consists of a U-shaped stranded conductor of fine copper wire, which goes under the fishplate. The bond has solid copper terminals, which are inserted in holes drilled in the rail. In each terminal is a plug of solder. An oxyhydrogen flame is then applied to the rail, and the solder melts out and fills the hole. —*St. R'y Jour.*, Dec., 7, and Int. Ed., Dec.

Rail Bonds on the B. & O. R. R.—Young.—He refers to an article on the same subject, recently noticed in the Digest, and says that the squeezing out of the rail bonds was due to the fact that not sufficient space was left between the angle bar and the web of the rail. As the top of the angle bar wore it was pressed against the bond, squeezing the latter out by mechanical action. He believes that if the angle bar were of a different design with some space between its inside surface and the rail the bond would be perfectly satisfactory.—*St. R'y Jour.*, Dec. 7, and Int. Ed., Dec.

Brake Tests in Electric Interurban Service.—A description of some tests made on the Union Traction Company's lines of Indiana, with cars equipped with air brakes and weighing about 32 tons. The front truck of each car was equipped with two 150-hp motors, and the rear truck had no motor. When running at a speed of 58 miles per hour stops were made in from 503 ft. to 522 ft. Some particulars are given of the brake equipment.—*St. R'y Jour.*, Dec., 7, and Int. Ed., Dec.

REFERENCE.

Care of Street Railway Controllers.—Berry.—A short article on street railway controllers, directing attention to the necessity of proper inspection and care of the various parts.—*Am. Elec.*, Dec.

Installations. Systems and Appliances.

A Model Small Central Station.—Obert.—An illustrated description of the municipal lighting plant at Wappinger's Falls, N. Y. Mixed service is supplied from a single type of alternating-current generator. The equipment consists of a direct-driven two-phase Westinghouse alternator, delivering current to a four-wire two-phase distribution system at 2200 volts and 60 cycles. The arc lighting circuits are supplied from step-up transformers, the current being kept constant by means of floating coil reactive regulators. The commercial service is supplied on meter by transformers at 104 volts. Special precautions are taken to protect the lines from lightning. Banks of arresters are distributed along the lines, and two separate banks of arresters are provided at the station. One at the ends of the pole lines outside the station, and one just inside the station. An induction coil is inserted between the two arresters, and another coil between the first arrester and the switchboard. No motor load is thus far carried.—*Am. Elec.*, Dec.

REFERENCES.

Steam Engineering in Central Stations.—Dawson.—The first of a series of well illustrated articles on "English, American and Continental Steam Engineering." This article deals with the equipment of British lighting and traction plants.—*Eng. Mag.*, Dec.

Electricity Supply Monopoly for London.—An editorial on the scheme of the London County Council to buy out, either compulsory or by agreement, all existing or potential company undertakings for the supply of electricity in the city of London. The scheme aims at complete municipal control of the electricity supply business within the metropolitan area.—Lond. *Elec.*; Nov. 29.

Wires, Wiring and Conduits.

New Automatic Wire Cleaner Used in Brooklyn.—This machine is used to make as good as new the wire in a burned out field, or other part of a street railway equipment. The wire is first heated in an oven to char the insulation and afterward is drawn through a machine. Wooden blocks first remove the insulation and clean the wire. It then passes through revolving and wire brushes, which polish it, and is then drawn through the center of a hollow winding head, upon which are bobbins for the tape. The winding head is hollow and may be filled with liquid insulation, which is thrown against the surface of the tape by centrifugal force at hollow pins placed on the periphery.—*St. R'y Jour.*, Dec. 7, and Int. Ed., Dec.

REFERENCE.

Interior Wiring.—An illustrated article with new and elaborate tables for ascertaining the sizes of direct-current feeders and mains. Explicit instructions for using the tables are given in the article. One of the tables gives the sizes of a feeder and a main, or a main and a branch, at a single operation.—*Am. Elec.*, Dec.

Electro-Physics and Magnetism.

Dielectric Constant of Paraffins.—Hormell.—An illustrated account of a series of experiments in which he reached the following results. For reversals as high as 800,000,000 per second the velocity of electrical disturbances along magnetic and non-magnetic wires of different diameters, is the same, thus showing that the magnetic properties of iron are not able to follow such rapid changes. The effective field around the Lecher wires, as far as it can be detected by means of an argon tube, does not extend more than 3 cm. from the wires, and the effect on the half wave within this region varies approximately inversely as the square of the distance from the wires. The dielectric constant of a given paraffin increases with the density of the paraffin. It increases rapidly from a temperature of 20 degs. above the melting point to a temperature of 30 degs. below the melting point. Among different paraffins the dielectric constant increases as the melting point of the paraffin increases. The dielectric constant increases as the wave length decreases. It is greater for short light waves than it is for short electric waves. Cauchy's formula as a

means of obtaining the index of refraction for indefinitely long waves does not meet the experimental facts.—*Am. Jour. of Sc.*, Dec.

REFERENCES.

Pressure of Light.—LEBEDEW.—The first part of an English translation in full of the German paper, an abstract of which was noticed in last week's Digest.—Lond. *Elec.*, Nov. 29.

Magnetizing Power of a Coil.—A didactic article with diagrams, explaining the magnetic field set up in the space about two wires carrying current, and leading up to a simple and concise explanation of reluctance, m. m. f. and the field intensity of a coil.—*Am. Elec.*, Dec.

ELECTRO-CHEMISTRY AND BATTERIES.

Losses of Energy in Lead Storage Cells.—B. HOPKINSON.—The first part of an article, illustrated by diagrams and tables. It has been remarked several times that the efficiency of a storage battery when used for taking up the variations of a rapidly changing load, as, for instance, a "floating" battery on an electric tramway, is very high, especially if compared with the efficiency of the same battery when used in electric lighting service, where the discharges last for long periods, though the rate of discharge may be comparatively low. He has made a series of experiments to ascertain definitely what the efficiency under different conditions might amount to. In order to give definiteness to the results, he put the cell through a cyclical process and repeated the process often enough to bring the cell to a perfectly steady state, as shown by the recurrence of the same value of the e. m. f. at the same period in successive cycles. He charged the cell for a certain time with a constant current, then discharged for the same time and with the same current, then charged again, and so on. The results are given in diagrams and tables. Some of the results are as follows: In one set of tests the loss of energy in one of the 10-minute cycles is from 35 to 40 per cent greater than in 10 of the 1-minute cycles, though the energy put in, in the course of charging, in the two cases is about the same. The latter case may be taken as typical of what goes on in a "floating" battery on a tramway. In such a case the cell is partially discharged, so that practically no gas is given off from the plates, the fluctuations of load have a period of about one minute, and the maximum current in and out is about equal to the one-hour discharge rate of the battery. In such a case an efficiency of about 90 per cent may be looked for, and the potential of the battery varies between 1.94 and 2.25 volts per cell. The conditions of another test approximated to the process in a battery used for lighting and worked normally in a state of partial discharge so that gas is only rarely given off from the plates. The efficiency is found to be 92 per cent, or but little greater than the one-minute cycle, before mentioned, though in the latter case the current is three times as great. The loss per ampere required is more than double that in the one-minute cycle; in other words, the lighting battery behaves, so far as loss of energy is concerned, as though it had a resistance more than double that of the traction battery. A certain part of the loss of energy is due to the internal resistance of the battery. For cycles having periods anywhere between 0.1 second and 10 seconds the dissipation is practically constant, and is that resulting from the resistance. He gives a numerical example to show that only a relatively very small part of the energy is dissipated in the fluid between the plates, while the remainder is due to the plates themselves. It seems probable that what he calls the electrolytic dissipation, i. e., the part of the dissipated energy which depends on the period and vanishes if the period is quick enough, is due to diffusion of the acid. During discharge sulphuric acid is absorbed at the surface of the plates, and it is restored again during charge. This gives rise to local concentration charges; and diffusion, with consequent dissipation of energy, is constantly going on. —Lond. *Elec.*, Nov. 29.

Aluminum Zinc Alloys.—J. W. RICHARDS.—Alloys containing between 1 and 10 parts of zinc to one part of aluminum are not useful. Alloys containing 2 parts of aluminum to 1 of zinc and 3 parts aluminum to 1 part of zinc have very valuable properties for the mechanical engineer, which are described.—*Eng. and Min. Jour.*, Nov. 30.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electric Polarization Balance.—MACCARONE.—A description of an instrument for showing the polarization of dielectrics and dielectric viscosity. It consists essentially of two equal, plane, horizontal, circular disks of brass with holes in the center. Between the disks is suspended a glass beam with a bifilar suspension. Two glass disks, such as microscope cover glasses, are attached to the ends of the glass beam, with their planes vertical. Two other glass disks are mounted in a fixed position within the orbit of the suspended disks. The oscillations of the beam are made perfectly aperiodic by means of a magnetic damping arrangement. The entire suspension weighs 0.6 gram. The whole apparatus is placed under a glass cover and is kept dry by means of sulphuric acid. On connecting the upper brass disk with the earth and charging the lower one from the battery of condensers, a uniform electric field is created between the two disks, and a gradually increasing repulsion is observed between the movable and the fixed glass disks. The repulsion only attains its maximum after a considerable time. On discharging the upper disk the beam returns to its normal position, but very slowly. The fact that it does not return fully to its normal position shows that no hysteresis proper exists. The apparatus may be used for determining the dielectric constant of any body, which can be obtained in four equal fragments.—*Phys. Zeit.*, Nov. 15; abstracted in Lond. *Elec.*, Nov. 29.

Maximum Demand Indicator.—An illustrated description of the Atkinson-Schattner maximum demand indicator which is suitable for both alternating and continuous-current circuits, and works on the principle of a balanced ammeter, an iron or laminated iron core being sucked into a coil proportionately to the current passing. A bent glass tube contains a certain number of steel balls. The instrument is set to zero by means of a brass ball adjustment. Any current going through the instrument deflects the moving portion and the balls slowly roll and fall down. The number of balls which rolled down is the record of the maximum demand. The action of the balls is said to be certain and slow. It records a current lasting on for over two minutes.—Lond. *Elec.*, Nov. 29.

REFERENCE.

Simple Method of Calibrating a Voltmeter.—BROWN.—An article with diagram showing how to calibrate a voltmeter by means of a standard instrument and an improvised water rheostat.—*Am. Elec.*, Dec.

TELEGRAPHY. TELEPHONY AND SIGNALS.

Wireless Telegraphy in Italy.—An article on the experiments made by officers of the Italian Navy since 1894. Recently they have succeeded in connecting Sardinia by wireless telegraphy with the mainland, the distance being 200 km. over the sea. "In a little while a fixed and regular communication between Rome and Sardinia, and the abolition of the submarine cable now in use, will be an accomplished fact." Besides the wireless telegraphy apparatus working on various Italian battleships, there are at present five stations established in the mountain region, and are in good order. Lond. *Elec. Rev.*, Nov. 29.

REFERENCES.

Wireless Telegraphy in the British Navy.—An illustrated description of the way in which the wireless telegraphy instruments are set up in the ships of the British Navy. All the battleships in the Mediterranean Squadron and most of the cruisers are supplied with these instruments.—Lond. *Elec. Rev.*, Nov. 15.

Cable Laying in the Philippines.—MOORE.—An illustrated article on the laying of cables by the United States Government, between the Philippine Islands. No technical information is given.—*Sc. Amer.*, Nov. 23.

Railroad Signals.—ELLIS.—A long illustrated article on the development of railroad signaling. He first discusses interlocking systems at junctions, crossings, etc., and later the block systems.—*The Polytechnic*, Nov. 22.

MISCELLANEOUS.

Inaugural Address.—LANGDON, PREECE, WORDINGHAM.—The first part of a reprint in full of Langdon's Brit. Inst. Elec. Eng. inaugural address, in which he gives a review of the service which electricity has rendered in the past in assisting the development of railway traffic, first in railway telegraphy, later in the development of tramways and electric railways. As regards the adoption of electric traction for main railways, he believes that the separate electric locomotive is likely to prove more suitable than the motor carriage, in view of the necessity of working both passenger and freight service on a unified system. In an editorial abstracts of two other inaugural addresses are also given one by Preece before the Society of Arts, on the great scientific discoveries of the nienteenth century, and one by Wordingham before the Manchester Section of the Brit. Inst. Elec. Eng. on foreign competition. He believes the British manufacturers bring out just as good machines as the foreigner. Regarding the recent

bills before the Brit. Parliament for power transmission schemes in bulk, he says they show a want of foresight, as they will require, for their carrying out, enormous quantities of plant of very large calibre, and as this demand is suddenly sprung upon the British manufacers who are not ready, the orders will go abroad.—Lond. *Elec.*, Nov. 22.

Medical Electro-Chemistry.—LEDUC.—A French Ass'n Adv. Sc. report on progress in medical electro-chemistry. He describes the various electrodes which are used in medical electro-chemistry and the different effects which they have according to theory. He then gives the results of experiments, and deals with the conductivity of the human body and shows that "the same allows one to determine the velocity of the ions in the organism." He points out the advantages which medicine can obtain from a reasonable application of electro-chemistry.—*L'Eclairage Elec.*, Nov. 2.

REFERENCES.

Glasgow Exhibition.—BATHURST.—The first part of an illustrated article on machine tools at the Glasgow Exhibition, with special reference to the requirements of dynamo and motor manufacturers. This part deals with boring and turning mills, and gear cutting.—Lond. *Elec. Rev.*, Nov. 22.

Telephony.—A description of the underground telephone network of Chaux-de-Fonds in Switzerland.—*Jour. Teleg.*, Oct. 25.

New Books.

THE INDICATOR HANDBOOK. A Practical Manual for Engineers. By Charles N. Pickworth. New York: D. Van Nostrand Company. 132 pages, 148 illustrations. Price, $1.50.

This is the second part of a work on the indicator, the first volume treating of the indicator, its construction and application. The present volume treats entirely of the indicator diagram, its analysis and calculation. The elementary principles involved are discussed in the first chapter, and in the second chapter a diagram is taken up, and through it is traced the action of the steam throughout its entire cycle of operation in the engine cylinder. Three of the seven chapters are devoted to analyses of diagrams from compound engines, gas and oil engines, and air compressors, pumps, etc., respectively. The final chapter is on diagram calculations.

In the three chapters on the specific applications of the indicator, much practical information is given concerning its use in setting valves and indicating defects in valve setting, engine design, leakage, etc. We regret to note that the author has not escaped from the absurd error that a point on an actual indicator diagram may be used to establish what he chooses to call the "theoretical" indicator card. It is astonishing in view of an unknown amount of cylinder condensation which may even attain 25 per cent or more, with a consequent effect on the lines drawn by the indicator, it should be considered possible that by the use of a point on one of these indefinite lines the "theoretical" events of steam action in a cylinder may be established by a construction dependent entirely on the point selected.

ELECTRICAL CATECHISM. An Introductory Treatise on Electricity and Its Uses. By George D. Shepardson, M. E. New York: American Electrician Company. 403 pages, 1516 illustrations. Price, $2.

That the first "Electrical Catechism" really worthy of the name should only now make its appearance, will surprise many, and the more so as the question and answer form of treatment in an elementary book appeals to such a wide circle of readers. However, a glance at the previous attempts at such a work will show the reason, for the average writer of an elementary electrical book does not know how to ask the questions logically and precisely, much less answer them. As a born teacher, and one who has been beset with questions on electrical subjects for at least 15 years, Professor Shepardson knows what questions need the answering, and what sort of an answer will best serve the purpose. The nearly 1100 questions asked by him are, therefore, clearly worded, and the order in which they are asked shows both careful planning and familiarity with modern practice. The answers are always to the point, and usually are supplemented by some bit of allied data or comment, so that this 400-page book is really answering some 3000 timely questions.

The general arrangement, while logical, is unusual in some points, as in using the heading "Elementary Motors" for information on electric bells, sounders and telephone receivers. However, this frequent touch of the unusual makes the volume all the more suggestive. The opening chapter on "Static Electricity" clears up some questions that usually vex beginners, and incidentally gives valuable hints on removing static electricity from belts and other machinery. Then comes a chapter on "Units," with portraits of ten of the men after whom our electrical units are named. Next a chapter on "Electric Circuits" with illustrations of various typical circuits and examples showing how to figure them. Fuses, rheostats, incandescent lamps, arc lamps, electric furnaces and other heating devices are all taken up under the head of "Heating Effects," while both primary batteries and accumulators are treated in the chapter on "Electro-Chemistry."

The part devoted to magnetism shows the range of the work, as it leads up from the simplest experiments on magnetic fields to the formulæ for calculating magnetization effects. The more recent measuring devices, such as electrostatic voltmeters and ground detectors, or the Wright maximum demand meter are briefly explained under "Instruments," while the chapter on "Measurements" tells both how to use such instruments and how to avoid harming them in practice. Also how to use low-reading voltmeters (in series with incandescent lamps) for measuring high voltages, or a voltmeter for measuring resistances, or incandescent lamps for locating grounds. Motor-starting rheostats get due attention in the chapter on "Motors," which, like the one on "Dynamos," abounds in practical hints for those in charge of such devices. The last 120 questions deal with alternating currents about as clearly as the absence of higher mathematics will allow. Compensating transformers for arc circuits, current rectifiers, rotary converters and even devices for determining instantaneous values of voltage or current are duly considered in this chapter.

A few items might well have had more attention, but the author may be saving these for some supplementary articles similar to the columns in *Electrical Industries* and the *American Electrician*, in which the bulk of this work originally made its appearance. Thus some chapters on main and snap switches, on lightning arresters for light and power circuits, and on insulating materials would make the books still more complete. However, these shortcomings are easily forgiven in view of the up-to-date accuracy of the information given and the practical common sense that shows up on almost every page. Thanks to this practical nature of both questions and answers, the careful reader can avoid many of the slips commonly made both in choosing and in using electrical devices; thus the chapters treating of the installation and care of dynamos will alone form a fine substitute for the average book devoted to this special subject. There is also a charm to the writer's pointed philosophy which makes the book unusually readable for a work of its kind, and in some cases this shows a strong vein of humor, as when he asks "if lightning rods are of any value except to the agent," or where he states that "to most people it would make little difference whether they got a shock of 2000 or of 10,000 volts."

The illustrations are ample and more up-to-date than is usual in such works, while an extensive index makes it easy to find every topic mentioned in either questions or answers. Mechanically, the book is also well planned to stand the steady thumbing which it will get as soon as the owner becomes aware of the completeness which makes this "Catechism" almost an encyclopædia.

Professor Shepardson says in his preface that "but little is presented which could not be found elsewhere," but very few will know where else to look for a good deal of the information, or what degree of accuracy to expect from other sources of such information. This accuracy and wide scope of the work will make it a welcome companion for those far along in electrical engineering work, while the simple and commonsense style, and the practical point of view shown on every page will make the volume appeal to the beginner as well. It is, therefore, a most timely work, without which an electrical library can hardly claim to be representative of the principles underlying modern electrical practice.

BOOKS RECEIVED.

METHODE PRATIQUE POUR CALCULAR LES MOTEURS ASYNCHRONES POLYPHASES. By Boy de la Tour. Paris: Ch. Beranger. 216 pages, 70 illustrations. Price, 12.50 francs.

INSTRUMENTS ET METHODES DE MESURES ELECTRIQUES INDUSTRIELLES By H. Armagnat. Second Edition. Paris: C. Naud. 614 pages, 230 illustrations. Price, 15 francs.

PRACTICAL MARINE ENGINEERING. By William F. Durand. New York: Marine Engineering, Inc. 706 pages, illustrated. Price, $5.

THE ENGINEERING INDEX. Volume III., 1896-1900. Edited by Henry Harrison Suplee, B. Sc., assisted by J. H. Cuntz. New York: The Engineering Magazine. 1030 pages. Price, $7.50.

Electric Power in a New Jersey Brewery.

The economy of employing electricity in industrial operations is becoming more and more apparent every day. There is hardly any field in the long list of manufactures in the United States where it is possible to affect a saving in the cost of production by the aid of electricity that this agency is not applied. Recently brewers have

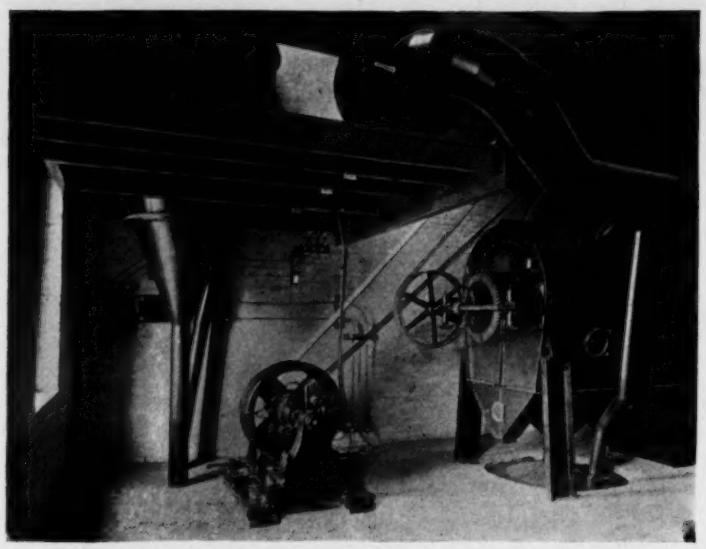


FIG. 1.—ELECTRICALLY-DRIVEN MALT CLEANER AND BLOWERS.

begun to awaken to the advantages offered by electric power, susceptible, they find, of general application to the wide range of apparatus they employ.

In the nature of the business it is necessary to employ heavy machinery in many parts of their buildings, and on many different floors, requiring a great amount of shafting, and many isolated engines. The power loss is tremendous, when the friction and inertia of shafting and heavy gearing, and radiation of heat along the lines of the numerous feeders to isolated engines is considered.

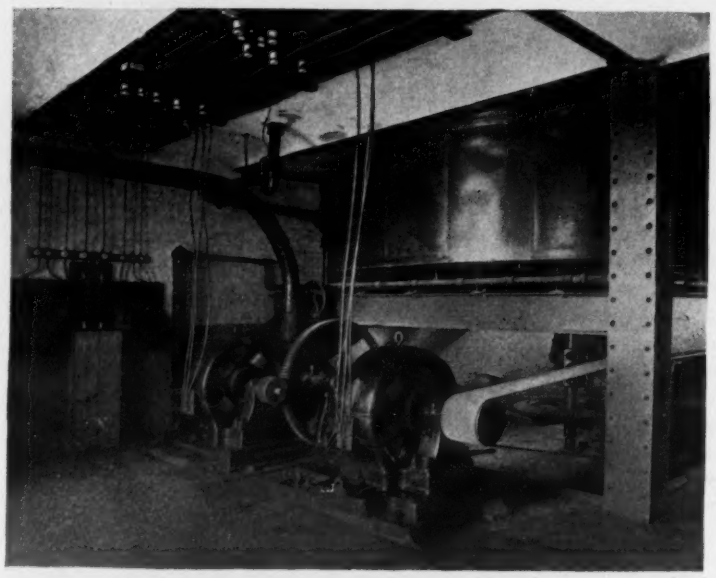


FIG. 2.—PUMP AND MASH MACHINE.

The atmosphere of the breweries, laden with moisture, is a continual source of trouble in maintaining proper tension of belting, especially in such cases where the distance is great between pulleys. The large quantity of shafting employed requires constant attention to keep the bearings properly lubricated.

The employment of separate electric motors for each machine, or set of machines, eliminates nearly all of the trouble mentioned.

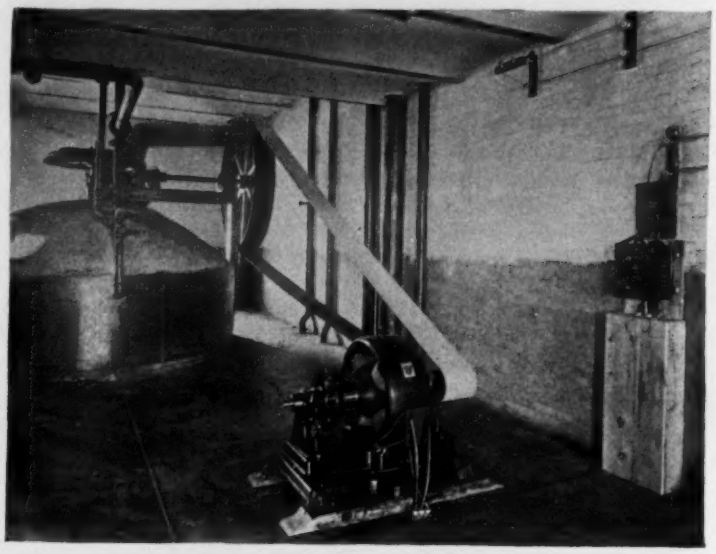


FIG. 3.—MOTOR-OPERATED COOKER.

When possible, the motors are direct connected, though the nature of the work of many machines requires the use of short belts that will slip when the motor is suddenly subjected to an overload, which sometimes occurs, and this slipping of the belt prevents injury to the motor.

It is also obvious that when motors act independently, only such machines are operated as are required, thereby saving the power necessary to drive idle pulleys and unused shafting.

The accompanying views are of Bullock motors in the Hudson County Consumers' Brewing Company's plant, Hoboken, N. J. The illustrations show motors operating the cleaning and grinding machinery, the mash machine, rotary pump, cooker and conveyors for grains. Fig. 1 shows a Taber rotary pump direct connnected to the motor with single reduction gears. This No. 6 pump is used for pumping the wet grains at 70 per cent moisture from the mash tub to the bins. There are three other Taber pumps, also direct connected

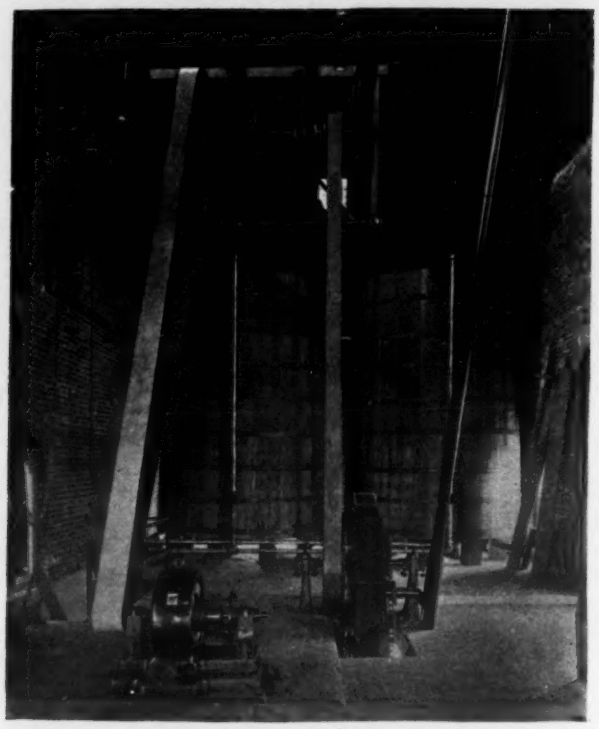


FIG. 4.—ELECTRICALLY-DRIVEN GRAIN CONVEYOR.

to motors in this brewery. Two of these pumps are used for pumping beer and hops to the extreme height of 80 ft.; the third is used for circulating beer. Similar motors are also used in other breweries for operating keg washers, keg elevators and the usual machines to be found in well equipped machine shops, such as are maintained in connection with large breweries.

Electrical Trades Society of New York.

The sixth annual meeting of the Electrical Trades Society, of New York, was held on Tuesday, Dec. 10, at 2 o'clock P. M., at 39 Cortlandt Street. Twenty-five members were represented. President R. E. Gallaher gave an interesting address, and reports were read by the secretary, Mr. A. P. Eckert, of the year's work.

The society has a membership in New York of 56 members. It is becoming of greater value every day, and the members speak highly of the work being accomplished.

The following officers were elected for the ensuing year: President, Mr. E. R. Gilmore, of the Western Electric Company; vice-president, Mr. H. A. Reed, of the Bishop Gutta-Percha Company; secretary-treasurer, Mr. A. P. Eckert, of the Safety Insulated Wire & Cable Company.

A New Milling Machine.

The accompanying illustrations show the latest pattern milling machine made by the Cincinnati Milling Machine Company, Cincinnati, Ohio, as exhibited by them at Buffalo. Fig. 1 shows a view of

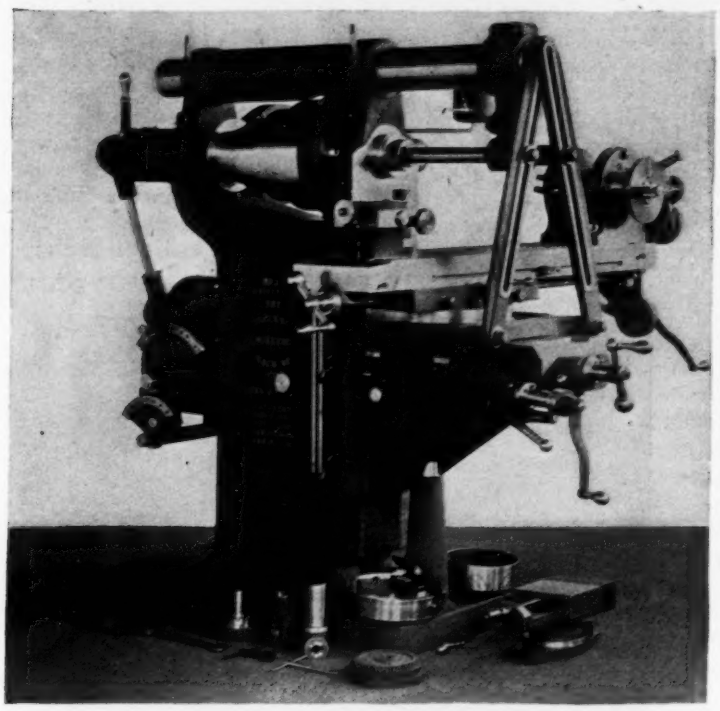


FIG. 1.—NEW PATTERN MILLING MACHINE.

the machine complete. The chief feature of the machine is the positive feed mechanism, which is shown in detail in Figs. 2, 3, 4 and 5.

The features incorporated in the mechanism are a positive gear-driven feed, a wide range of feed changes and means for changing from any one rate of feed to any other rate of feed conveniently and without stopping the machine.

Part of the mechanism is placed at the rear end of the milling machine spindle, and part is incased in a gear box at the rear of the column. The connection between these two parts of the mechanism is by means of a vertically inclined shaft.

Figs. 2 and 3 show, respectively, a section through the upper gear box and the upper gear box complete on the column of the machine. Figs. 4 and 5 show, respectively, a rear view of the lower gear box, with covers removed, and a front view of the same mechanism showing the arrangement of the shifting levers. The operation of the mechanism, briefly stated, is as follows: Referring to Fig. 2, motion is transmitted to the shaft *B* by sliding the gears on *B* so as to bring either one of them into mesh with the proper gear on the spindle, or the gears may be set in the intermediate position, shown in the sectional drawing, in which case no motion is imparted to *B*. This position of the gears throws out the entire feed mechanism. The shaft *B* drives the vertically inclined shaft *M*, which in turn drives the shaft in the lower gear box upon which are mounted the spur gears *R* and *S*, as shown in Fig. 4, through the mitre gears at *G*, which are of steel, case hardened. All the spur gears of the feed mechanism are of steel. Inside of the lower gear box will be seen two cones of four gears each, running loose on their shaft and driven independently by the gears *R* and *S*, the smaller gear *R* engaging the largest gear on one cone, and the larger gear *S* engaging the smallest gear on the other cone, thus imparting widely different speeds to the two cones.

From these cones, motion is transmitted to the various feed screws through an intermediate gear, which is made to slide on its shaft by means of the rack and sector, and placed into correct position for engaging any one of the cone gears, by means of the lever which actuates the sector. This is the lower lever shown in Fig. 5. The position of this lever, at any time, indicates the rate at which the machine is feeding in thousandth of an inch per revolution of spindle, by means of raised figures on the lever quadrant.

The lower lever having been placed into position to obtain the desired rate of feed, the intermediate gear is brought into mesh with

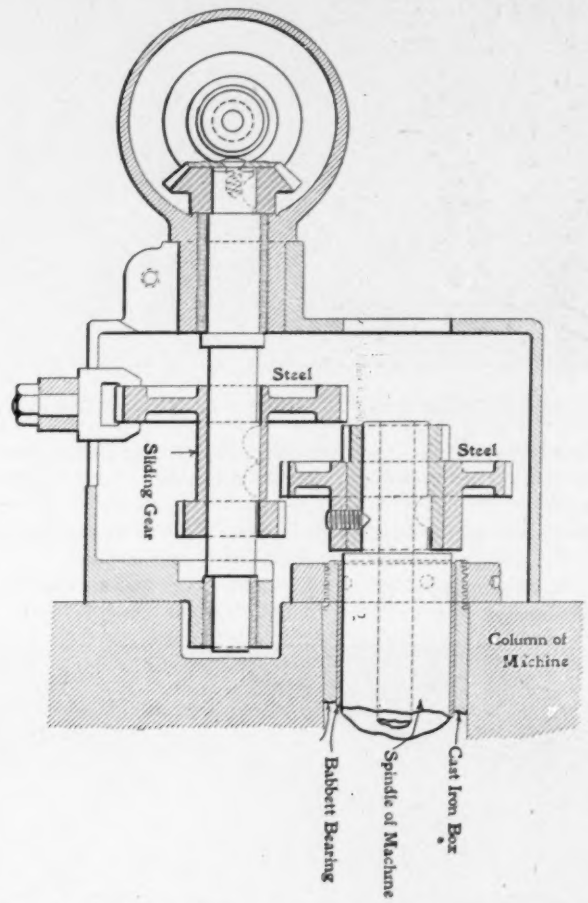


FIG. 2.—SECTION THROUGH UPPER GEAR-BOX AND SPINDLE.

the proper cone gear by the upper lever in Fig. 5, which moves the entire lower portion of the mechanism. This is accomplished by means of a helical groove in the hub of the lever, which engages a pin in the slide upon which are mounted the lower lever, sector, rack and intermediate gear. By means of the combination of these two mechanism 16 different speeds are imparted to the feed shaft, advancing by even graduations from .006 inch to .300 inch for each turn of the spindle. The lower lever acting as an indicator enables any one to tell at a glance just how fast the machine is working.

From the foregoing it is plain that by simply shifting the levers on the feed mechanism, any one of the 16 different rates of feed may be obtained, and a change from any one rate of feed to any other may be made without stopping the machine, since there are no change gears to interpose nor belts to shift. Any one of these rates of feed may be used in combination with any of the 16 different spindle speeds, providing in all 256 different combinations.

The spindle speeds, which are 16 in number, and vary from 9 to 250 turns per minute, have been chosen with a view to secure the proper cutting speed for cutters of standard diameters. As illustrations and taking spindle speeds of 15, 150 and 350 r. p. m., the cutter diameters with a surface speed of 20 ft. per minute are 5 inches, ½ inch and ¼ inch, respectively; at a surface speed of 40 ft. per minute the diameters are 10 inches, 1 inch and ½ inch, respectively; and for a surface speed of 60 ft. per minute the diameters for the two higher revolutions are 1½ inches and ¾ inch, respectively.

These machines are finding great favor among manufacturers of electrical machinery and appliances. We are told on the authority of the manufacturers, that orders have recently been placed by three different electrical houses which aggregate over 100 machines. They consider that their success in placing these orders is largely due to the positive feed mechanism. Some of the advantages of this particular mechanism may be enumerated as follows:

With it the capacity of the machine for removing metal is limited only by the pulling power of the main driving belt. The rate of feed can be changed practically instantaneously. It is positive, at all times, imparting an even motion to the table, thereby avoiding the broken cutters and spoiled work which so often result from a slipping feed belt.

In addition to the new feed mechanism, there are other improvements on these machines, notable among which are a telescopic vertical feed screw which does away with the necessity of cutting a hole through the floor; a clamping device, which enables one to firmly lock the knee to the column or the saddle to the knee when the longitudinal feed alone is being used, thereby wonderfully increasing the rigidity of the machine. Sliding covers on the knee, which protect the feed screws from dirt and cuttings, and a cylindrical overhanging arm, which, in addition to the regular support for the arbor, is also provided with a support which can be adjusted close to the cutter, thus supporting the arbor at any point in its entire length.

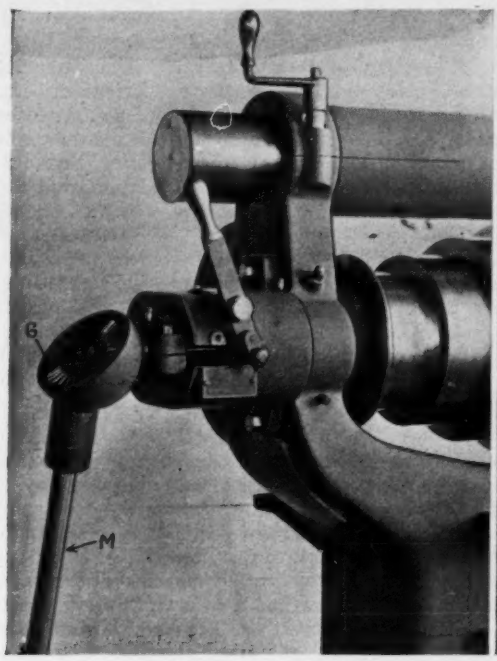


FIG. 3.—UPPER GEAR-BOX, WITH COVER OVER MITRE GEARS REMOVED.

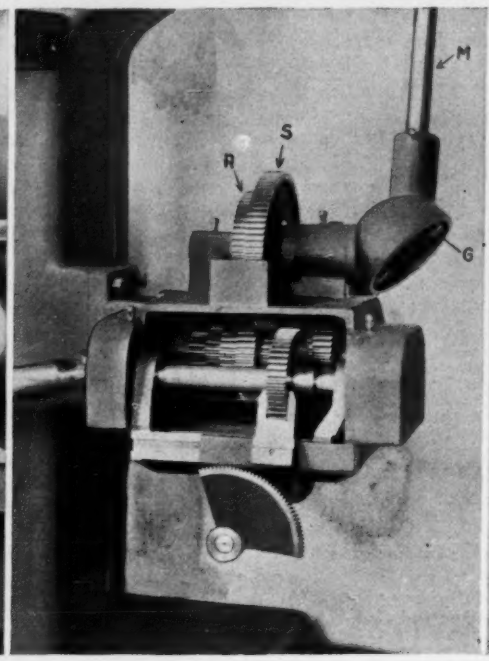


FIG. 4.—REAR VIEW OF LOWER GEAR-BOX.

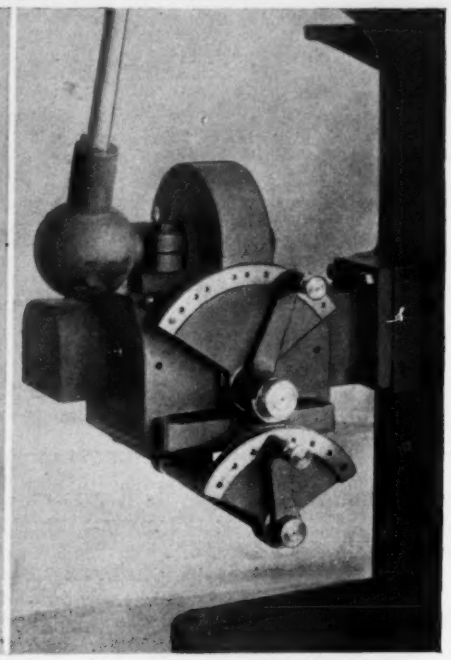


FIG. 5.—FRONT VIEW OF LOWER GEAR-BOX, SHOWING SHIFTING LEVER.

Leich Selective Telephone Signal System.

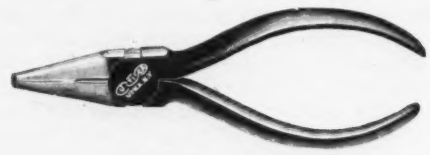
The Leich selective signal system, which was placed on the market some time ago by the Metropolitan Telephone & Electric Company, of Chicago, is entering largely into use. A recent installation completed by the above-named company for the Northwestern Indiana Telephone Company has demonstrated, it is stated, that the instruments work perfectly, without needing any adjustment when once installed, due, in large measure, to the absence of spring action. The circuits of the instruments have been very much simplified, and the liability of the instruments to deteriorate while in use is no greater than that of the ordinary polarized ringers now used so extensively. The additional apparatus which is used in combination with each polarized ringer to adapt it for selective signaling purposes, consists of one condenser and one impedance coil. The condensers are placed in series in the ringing circuits, so that they check absolutely any unnecessary flow of common battery current while the instruments are in use. The instruments are all provided with approved forms of lightning arrester and protective apparatus, so that the condensers are not influenced by lightning discharges.

The instruments are adapted to operate both from power generators and Warner pole changers, and are thus adapted for both large and small exchanges. The Warner pole changer used in the operation of the system is preferably made in a single instrument, provided with two sets of springs for giving the high and low-frequency currents required, so that very little additional expense is necessary to adapt ordinary central station apparatus for use in connection with party-line telephones.

The instruments as furnished by the company are guaranteed to operate without adjustment of any kind, except that necessary for ordinary polarized ringers, so that no more time is required to install instruments of this character than is required to install an ordinary telephone instrument. When the instrument is installed, the remaining subscribers on the same party-line need not be inconvenienced by sending test currents over the line to test the instruments, as the same, when installed, is ready for use without adjustment.

Novelties in Pliers.

The Smith & Hemenway Company and the Utica Drop Forge & Tool Company, 296 Broadway, New York, are offering as their latest novelty in pliers a side-cutting, long-nose form. The advantages claimed are that having a long, narrow nose it will be of use in deep, narrow quarters, in which an ordinary tool will not work, and also will do the work of a regular tool. It is convenient to carry. Every tool is carefully tested at the factory before sending out. It can be used by telephone manufacturers, machinists, engineers, electricians and jewelers.



LONG-NOSE PLIERS.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money closed at 6 per cent on call; time money, 5@5½ per cent for sixty to ninety days, 5 to 6 per cent for four, five and six months. The stock market, after suffering from speculative liquidation, due to high money rates, became steadier towards the end of the week, and showed a better tone. Apart from money, the principal factors which affected the market were favorable. Railroad earnings continue good, and the business activity of the country does not slacken. Tractions sympathized with the general weakness, and closed with net losses. Brooklyn Rapid Transit kept within a range of about 2 points, closing at 62⅝—a net loss of ⅜. Metropolitan closed at 158⅞, ex-div., which represents a net loss of ⅝. General Electric was the exception to the electric list, closing at 282, a net gain of 1⅞ points, the sales aggregating 8025 shares. Westinghouse closed at 147⅛, a net loss of 2⅜ points, on sales of 2000 shares. Western Union remains unchanged from last quotation, the closing price being 91. Following are the closing quotations of Tuesday, Dec. 17:

NEW YORK.

	Dec. 10.	Dec. 17.		Dec. 10.	Dec. 17.
American Tel. & Cable..	—	97	General Electric.....	282	281
American Dist. Tel.....	—	36	General Carriage.....	1¾	1½
Brooklyn Rapid Transit..	62¼	62½	Hudson River Tel.....	110	104
Ches. & Pot. Telephone..	66	66	Metropolitan Street Ry..	159	161
Commercial Cable.....	—	181	N. E. Elec. Veh. Tran..	—	—
Electric Boat.....	19	19	N. Y. Elec. Veh. Tran...	10	12¾
Electric Boat pfd.....	40	40	N. Y. & N. J. Tel.....	167	167
Electric Lead Reduc'n...	1⅜	1⅞	Tel. & Tel. Co. of Am...	—	—
Electric Vehicle.....	2½	2½	Western Union Tel.....	91⅛	91¼
Electric Vehicle pfd.....	4½	4	West. E. & M. Co.....	148½	147½

BOSTON.

	Dec. 10.	Dec. 17.		Dec. 10.	Dec. 17.
Am. Tel. & Tel.....	160½	161	Mexican Telephone.....	2	2
Cumberland Telephone...	—	—	New England Telephone.	132	134
Edison Elec. Illum.....	—	235	Westinghouse Elec.....	74½*	—
Erie Telephone.....	16	19	Westinghouse Elec. pfd.	—	—
General Electric pfd.....	—	—			

PHILADELPHIA.

	Dec. 10.	Dec. 17.		Dec. 10.	Dec. 17.
American Railways.....	44	43	Phila. Traction.....	97¾	97¼
Electric Storage Battery.	61	60	Philadelphia Electric....	4½	4¾
Elec. Storage Batt'y pfd.	61	60	Pa. Electric Vehicle.....	¾	½
Elec. Co. of America.....	6⅛	6	Pa. Elec. Veh. pfd.....	1⅝	2

CHICAGO.

	Dec. 10.	Dec. 17.		Dec. 10.	Dec. 17.
Central Union Telephone.	—	40	National Carbon pfd.....	84*	85½
Chicago Edison.....	155	—	Northwest Elev. com....	36¼	35*
Chicago City Ry.....	185½	187	Union Traction.....	10½	10½
Chicago Telep. Co.....	240	240	Union Traction pfd.....	47	47
National Carbon.....	20	19¾			

*Asked.

STROWGER AUTOMATIC TELEPHONE.—Note was made in this department last week of the Strowger Automatic Telephone Company in Illinois, with a capital of $2,000,000. This company has secured the manufacturing rights for the United States of the Strowger Automatic Telephone Exchange and its manufacturing plant in Chicago. The interests back of it are the people who control the Illinois Telephone & Telegraph Company, which is preparing to compete with the Chicago Telephone Company. It will introduce the Strowger instrument, which is operated without operators. The incorporators of the new company are Edwin W. Gearhart, James C. Law and Albert G. Wheeler, Jr. They represent Clarence D. Simpson, Thomas H. Watkins, of Scranton, Pa.; Charles B. Eddy, of New Mexico, and J. B. Russell & Co., bankers, of Scranton, New York and Chicago. These people recently bought the $5,000,000 bond issue of the Illinois Telephone & Telegraph Company. The Illinois Telephone & Telegraph Company will install telephones in Chicago on the same plan as the gas company furnishes gas to its consumers. The telephones will be placed in offices and residences without charge to the tenants, except as they have use for them. By this method the company expects to be able to install a system in that city of at least 100,000 telephones. A guarantee will be given to each patron that the cost a year shall not exceed $85 for business and $50 for residence instruments. The Strowger system has been used for several years at Augusta, Ga.; Princeton, N. J.; Geneva, Ithaca and Perry, N. Y.; Albert Lea, Minn.; Trinidad, N. M.; New Bedford and Fall River, Mass. The new Automatic Electric Company will begin business with an order from the Illinois Telephone & Telegraph Company for a switchboard and its appliances and devices for 25,000 telephones.

NEW HAMPSHIRE TRACTION.—With the completion of the New Hampshire Traction Company, W. D. Lovell and his associates round out the construction and combination of the extensive system of electric roads stretching from Haverhill and Amesbury on the south to Dover and Rochester on the north, reaching Hampton Beach and Exeter, with connections to Portsmouth well under way. It is understood that the New Hampshire Traction Company is backed by a strong syndicate of Boston and New York capitalists, who will immediately push the development and perfecting of the properties, giving the sections covered by their lines a thorough up-to-date system of electric roads. The New Hampshire Traction Company has a capital stock of $1,000,000. Officers are as follows: President, W. W. Woodman; vice-president, C. H. Tenney; treasurer, H. A. Tenney; clerk, Samuel W. Emery. The completion of this combination leaves Mr. Lovell and his associates free to push the immediate completion of their roads to the West, which will bring the cities of Nashua, Lawrence, Lowell and Manchester into direct connection with the lines of the New Hampshire Traction Company. It is expected that all these lines will be completed, and in operation by early spring. The entire system is being constructed in the most thorough manner.

PNEUMATIC TOOL DEAL.—A syndicate comprising financial interests in New York and elsewhere has been formed by subscribers, to the amount of $5,000,000, to consolidate leading concerns that enter largely into the manufacture of hoists, cranes and pneumatic tools. This has already been noted in our columns. The Chicago Pneumatic Tool Company will be the nucleus of the consolidation, and the authorized capital will be $5,000,000. There will also be an issue of $2,000,000 bonds, bearing 5 per cent interest. Only one class of stock will be issued. The following companies have been taken into the combination: Chicago Pneumatic Tool Company, Chicago; Chisholm-Moore Company, Cleveland; Boyer Machine Company, Detroit; Franklin Air Compressor Company, Franklin, Pa., and New Tate-Howard Pneumatic Tool Company, Limited, of London, England. The syndicate has made a contract with the Chicago Pneumatic Tool Company under which the latter is to issue and deliver its stock and bonds in consideration for stocks of companies named.

OMAHA CONSOLIDATION.—A special dispatch from Omaha of Dec. 13, says: Representatives of the franchise corporations of Omaha, including the Omaha Street Railway, Omaha Gas Company, Omaha & Council Bluffs Bridge & Motor Line & Electric Light Company, are on the way to New York to confer with J. P. Morgan, who is at the head of a syndicate formed to buy these concerns, provided terms can be made. The scheme has been under way for some time, and has gone so far that an expert has been sent to make examinations of all the properties, but the price placed by the street railway company was so high that negotiations were not closed. The company demands $7,000,000 for its property, or 90 per cent of the capital stock plus $2,500,000 in outstanding bonds. The purchase of the Fremont Power & Canal Company will be discussed also. Thirty million dollars are involved in the transaction. The proposed development of water power to furnish current to the Omaha plants has already been discussed in these pages.

ERIE TELEPHONE FINANCES.—It is announced from Boston that Messrs. Kidder, Peabody & Co. and President Fish of the American Telephone & Telegraph Company are arranging the Erie Telephone reorganization plan. The successor company will issue $16,000,000 preferred and $16,000,000 common stock. The American Company, through Erie's successor, will control all except the Michigan Company. As every holder of four shares of Erie stock must take one share at par, the assessment loss is $3.75 per share. Erie people must also surrender one of their Erie shares without consideration. Therefore, Erie at 18 means new Erie common at 29 and preferred at 85.

WESTERN UNION TELEGRAPH.—The report of Western Union for the December quarter confirmed reports that the statement would show a satisfactory gain over last year. The increase in net revenue was $137,170, and the increase in surplus after dividends $132,210. The earnings on the stock were $1,606,000, or 1.6 per cent. Earnings for dividends for the six months have been $3,316,276, or 3.3 per cent on the stock, indicating for the year fully 6 per cent earned, as against 5 per cent paid. This gives a margin over the dividends large enough to strengthen confidence in regard to the maintenance of the 5 per cent rate.

BUFFALO BELL TELEPHONE.—It is announced that the Buffalo Bell Telephone Company has decided to dispose of the remaining $1,000,000 of treasury stock to the present stockholders. The company, it is stated, was originally capitalized for $5,000,000, of which $4,000,000 was issued and sold.

DIVIDENDS.—The Union Switch & Signal directors have declared the regular quarterly dividend of 2 per cent on the preferred stock and 1 per cent on the common. The directors of United Traction & Electric Company have declared a dividend of 1 per cent, payable Jan. 1. The regular quarterly dividend of 2½ per cent and 3½ per cent extra on Westinghouse Air Brake has been declared Three months ago Westinghouse Air Brake declared 3½ per cent extra; six months ago, 3 per cent extra; nine months ago, 3½ per cent extra; a year ago, 3½ per cent extra, and 15 months ago, 5 per cent extra. The directors of the United Gas Improvement Company have declared a quarterly dividend of 2 per cent ($1 per share), payable Jan. 15, 1902, to stockholders of record at close of business Dec. 31. The Western Union Telegraph Company has declared the regular dividend of 1¼ per cent. The Safety Car Heating & Lighting Company has declared a quarterly dividend of 2 per cent, payable Dec. 23. The Hall Signal Company has declared a regular quarterly dividend of 1 per cent. Otis Elevator Company has declared the regular quarterly dividend of 1½ per cent on preferred stock, payable Jan. 15.

CONSOLIDATION AT SAVANNAH, GA.—It is announced that the Edison Electric Illuminating Company has acquired the street railway interests in Savannah. The concern is owned principally in Boston and Savannah. George Parsons was president and majority owner of the stock in the old street railway company, and it is understood that he obtained considerably more than $1,000,000 for his interest. The city and suburban railway lines aggregate more than 25 miles. The Edison Company now operates a lighting plant, and has the city contract. The two companies are capitalized at about $3,500,000. They will be consolidated, and new securities issued. George J. Baldwin, president of the Edison Company, will be president of the new corporations. This consolidated interest a few weeks ago secured control of the electric lighting and street railways in Houston, Texas. It is the understanding that Texas oil will be used as fuel, and that a line of tank steamships will be established between Savannah and Galveston or Port Arthur.

OHIO TROLLEY CONSOLIDATION.—The Tuscarawas Railway Company and the Tuscarawas Electric Company have filed articles of consolidation with the Secretary of State, and hereafter will be known as the Tuscarawas Traction Company, with a capital stock of $350,000. This is supposed to be a step toward the plan of the Pomeroy-Mandelbaum syndicate of Ohio street railway companies. Reports come from Hamilton, Ohio, that the Southern Ohio Traction, Hamilton & Lindenwald Electric Transit, Cincinnati & Northwestern and Miamisburg & Germantown Traction are soon to consolidate, which will include practically all roads between Dayton and Cincinnati. These properties are said to be controlled by the Mandelbaum-Pomeroy syndicate of Cleveland. The capital of the four roads exceeds $3,000,000. The Lake Shore Electric Railway, owned and controlled by the Moore-Everett syndicate, has been opened for passenger service. It is the longest electric railway in the world, stretching from Painesville, Ohio, via Cleveland, Lorain, Norwalk, Toledo and Detroit to Port Huron, Mich.

GENERAL ELECTRIC.—It is stated by Wall Street organs that in the last two or three years there has been a notable accumulation of General Electric stock in the hands of a few people, these people being closely identified with the company. It has been said, in fact, that less than a score of men own two-thirds of the stock. This may be an exaggeration, but it is certain that ownership is now decidedly concentrated, whereas in 1898 and previously, it was very widely scattered. During that time the stock has quadrupled in value, rising from about 70 to 280. Practically the only official information that has been forthcoming in that period has been the quarterly dividends and the annual reports. Up to this time nothing official has been said respecting the intention of the managers to restore the capital written off in 1898, and those stockholders who have regarded only official information know nothing whatever about it.

BIG KENTUCKY TROLLEY SCHEME.—Articles incorporating the Blue Grass Consolidated Traction Company, with a capital of $7,000,000, divided into 70,000 shares, have been filed in Kentucky. The incorporators are H. C. Beatty, George B. Davis and H. B. Davis, of Detroit; C. B. Knapp, Jr., of Chicago, and W. J. Loughridge, Hal P. Headley and M. C. Alford, of Lexington. The purpose of the company is to construct electric railways from Lexington, Ky., to eight or nine surounding county seats. The company will absorb the Blue Grass Traction Company, which has secured the necessary franchises for the system.

COMMERCIAL ELECTROZONE COMPANY.—The Commercial Electrozone Co., Philadelphia, is apparently in serious difficulties. In the suit of Geo. T. Vickers against the company, Chancellor Magie has ordered that stockholders and creditors show cause on Dec. 23 why the receiver should not sell the company's assets. There seems no good reason, however, why an excellent demand for electrozone should not be enjoyed if the business were pushed.

BESSEMER (ALA.) LIGHTING SALE.—The Birmingham Railway, Light & Power Company has purchased the plant of the Bessemer Electric Lighting Company at Bessemer for $25,000. The purchasers will expend $250,000 in the enlargement and modernizing of the plant, and will use the current to operate a loop electric railway system 25 miles around between Bessemer and Birmingham.

NEW YORK ELECTRIC VEHICLE TRANSPORTATION.—The directors have recommended a reduction of the capital stock to $5,000,000 from $25,000,000.

Commercial Intelligence.

THE WEEK IN TRADE.—Reports received during the week by the mercantile agencies show an enormous business going forward in all the industries, heavy bank clearings and unprecedented railroad earnings. Nearly all advices touching upon jobbing business are encouraging and the year's results so far as ascertained are, on the whole, very favorable. Among the industries iron and steel are easily first in strength of demand and prices, and the situation is buoyant. The railway gross earnings for November are the best on record for that month. Roads with a mileage of over 106,000 report a total of $70,632,181, as against $62,966,000 for November last year, a gain of 12.1 per cent. Pacific Coast roads report the heaviest increase, 28.1 per cent, followed by the grangers with a gain of 22.9 per cent. The business failures for the week, as reported by *Bradstreet's*, numbered 233 against 237 the week previous and 247 the same week last year. The copper market, as noted elsewhere in these columns, continues to be very unsettled, and on Friday a reduction of 1¼ cents was reported, making the price 15.37 cents for Lake and 15.25 for electrolytic.

THE COPPER SITUATION.—In our issue of Sept. 28 last we asserted editorially that 15-cent copper might soon be reached, judging from the condition of the copper market at that time. Since then the conditions have not improved, indeed they have been going from bad to worse, and now the prediction is almost an actual realization, the quotations having dropped within ¼c. of that figure. In London the copper situation has apparently reached the crisis. A cablegram dated Dec. 13 stated that the directors of the Rio Tinto Company had made all the propositions to the Amalgamated Copper Company that it intended to offer, and that whatever settlement may be reached lies entirely with the Amalgamated Company. During the week the Amalgamated Copper Company officially reduced the price for Lake to 15⅜c. and for electrolytic 15¼c. An expert and dealer in the metal predicts that it will fall below 15 for electrolytic. An alliance between Amalgamated and Rio Tinto interests, he asserts, will not avail to decrease the supply from other sources sufficiently to curtail production. The present demand is so short of the accumulated supply that a further break is looked for. In commenting on the situation, the *Engineering and Mining Journal* says the collapse of the Secretan corner was under entirely different conditions from those now existing. There is a general anticipation, it says, that prices must be reduced before long, and in consequence business is almost at a standstill, buyers taking only the limited quantities, which their daily necessities require. The London prices are equivalent to 12 to 12½ cents in New York, for standard, which is equal to 13 and 13½ cents for electrolytic or refined copper. On the New York Stock Exchange Amalgamated Copper was the most active stock on the list during the week, due to the widespread uncertainty which surrounds its position. The price fell as low as 65⅝. A part of the loss was regained, however, towards the end of the week on the apparent predominance of favorable reports concerning the situation. But at the best, the condition of copper is so uncertain that it is impossible to predict with any confidence where the trouble will end.

WESTINGHOUSE PITTSBURG ENTERPRISES.—Note has been made in these columns recently of the new industrial developments around Pittsburg due to the initiative and leadership of Mr. George Westinghouse. With reference to these it is now announced that the Westinghouse Foundry Company, recently organized at Pittsburg, has applied for a charter. The incorporators are George Westinghouse, Herman Westinghouse, George C. Smith, William Scott and W. D. Updegraff. This new company will build a very large foundry at Stewart Station, on the Pennsylvania Railroad, about 25 miles from Pittsburg. The various Westinghouse, steam and electrical enterprises now run into such large units, they might easily, of themselves, keep such an establishment as this very busy.

BOILERS FOR JAPANESE LIGHTING PLANT.—The Nagasaki Electric Light Company, of Nagasaki, Japan, is to be equipped with a 300-hp horizontal boiler ordered from Thayer & Co., Incorporated, Taylor Building, 39-41 Cortlandt Street, New York City. The boiler will be manufactured by the Aultman & Taylor Machinery Company, Mansfield, Ohio.

EXPORTS OF ELECTRICAL MATERIAL AND MACHINERY.—The following are the exports of electrical material, machinery, etc., from the port of New York for the week ended Dec. 11: Argentine Republic—82 pkgs. material, $2,788; 2 pkgs. machinery, $485. Antwerp—3 pkgs. material, $479. Azores—6 pkgs. material, $310. Brussels—23 pkgs. material, $389. British Australia—15 pkgs. wire, $478; 42 pkgs. machinery, $3,290; 139 pkgs. material, $9,702. Birkenhead—3 pkgs. wire, $115. Bremen—2 pkgs. material, $65. Brazil—117 pkgs. wire, $4,584; 266 pkgs. material, $2,716; 4 pkgs. machinery, $300. Berlin—5 pkgs. machinery, $100; 1 pkg. material, $17. British Guiana—10 pkgs. material, $500. British West Indies—47 pkgs. material, $902. British Possessions in Africa—59 pkgs. material, $3,352. British East Indies—91 pkgs., material, $6,079; 17 pkgs. machinery, $3,000. Central America—1 pkg. material, $15; 44 pkgs. material, $639; 2 pkgs. wire, $47; Cardiff—1 pkg. wire, $15. Christiania—1 pkg. material, $50. Cuba—17 pkgs. machinery, $2,853; 96 pkgs. material, $2,496; 140 pkgs. wire, $175. Ecuador—79 pkgs. material, $900. Glasgow—12 pkgs. machinery, $1,320; 41 pkgs. material, $795. Genoa—12 pkgs. material, $1,050. Havre—15 pkgs. material, $725. Hamburg—116 pkgs. material, $2,843; 2 pkgs. wire, $64. Liverpool—72 pkgs. machinery, $5,230; 47 pkgs. material, $2,065; 491 pkgs. material, $26,500; 21 pkgs. wire, $1,394. Lisbon—24 pkgs. material, $692. Leicester—3 pkgs. wire, $330. London—176 pkgs. machinery, $15,083; 141 pkgs. material, $7,558. Manchester—22 pkgs. machinery, $3,800. Marseilles—6 pkgs. material, $550. Mexico—22 pkgs. material, $1,756; 2 pkgs. machinery, $146. Naples—15 pkgs. material, $1,000. Newcastle—17 pkgs. machinery, $2,800. Nova Scotia—2 pkgs. material, $19. Rome—5 pkgs. material, $500. Rotterdam—2 pkgs. material, $145. Southampton—10 pkgs. material, $353; 3 pkgs. machinery, $179. Stockholm—4 pkgs. machinery, $257. Trieste—22 pkgs. machinery, $857; 1 pkg. electrical material, $41. U. S. Colombia—10 pkgs. material, $319. Vienna—8 pkgs. machinery, $920. Venezuela—3 pkgs. material, $41.

CROCKER-WHEELER COMPANY'S LARGE SALES.—The year which has just come to a close has been a prosperous one for the Crocker-Wheeler Company, of Ampere, N. J. They report a record-breaking midwinter business, and find it difficult to keep the production up to the demand. The following are some of the recent shipments: Two 400-kw generators to the Vandergrift Construction Company; one 300-kw generator to Stetson & Co., of Philadelphia; one 150-kw generator to the D'Olier Engineering Company, of West Camp, N. Y., and one 40-kw generator and 28 motors to the Smith-Brooks Publishing Company plant in Denver, Colo. The United States Tube Company, of Buffalo, N. Y., has been supplied with a motor equipment, and the electrical equipment of the Con. P. Curran printing establishment in St. Louis, Mo., which takes the place of line shafting, has been completed. Orders for a large number of motors have been received from Armour & Co., the American Bridge Company and the Marion Steam Shovel Company. An order for a 30-kw special generator has been received from H. H. the Sultan of Linga. The machine is to be installed in the royal palace, which is on an island near Singapore.

PAWLING & HARNISCHFEGER, Milwaukee, Wis., report business as excellent in every respect. The orders booked within the last 30 days represent an aggregate of 513 tons, about 90 per cent arising through specification for electric traveling cranes with the remainder derived from electric hoists. This output will largely be for use in iron and steel mills, although the orders for electric lighting and street railway stations are gratifying. Conspicuous as buyers in these lines are the Commonwealth Electric Company, Chicago, two 8-ton and one 10-ton, and the Wisconsin Traction, Light, Heat & Power Company, Appleton, Wis., one 20-ton electric traveling crane. Pawling & Harnischfeger state that the utility of electric hoists in the smaller electric light and street railway stations is daily becoming more appreciated. Current in such plants is always ready, and at a nominal cost both for service and conveyance. The installation of the hoist merely requires a simple suspended I beam, which can be so arranged as to permit ready switching or transfer of hoist to any part of the building; in fact, it can be run into the yard or to adjoining buildings.

CABLE FOR MEXICO.—In a report to the State Department, W. W. Canada, United States Consul at Vera Cruz, Mexico, says the Mexican Government has contracted with the Safety Insulated Wire & Cable Company, of New York, for a submarine cable to be laid between Vera Cruz, Frontera and Campeche. The cable is to be 472 nautical miles long; there must be enough to reach a depth of 49 ft. in the port of Campeche and 65 ft. in the ports of Vera Cruz and Frontera. It is to be made of nine copper wires, protected by 16 galvanized iron wires for the deep sea and 18 additional steel wires for the coast. The manufacture of the cable will be under the supervision of the Mexican Government. The company is to receive for the work $600,000 gold, of which $283,000 is to be paid when the cable is placed in service and the balance in two and four months thereafter. The cable must be ready for service on April 2, 1902.

OUTPUT OF BELL TELEPHONES.—The American Telephone & Telegraph Company instrument statement for the month ended Nov. 20 shows:

	1901.	1900.	1899.	1898.
Gross output	88,497	52,208	69,117	35,159
Returned	27,510	36,412	19,992	15,486
Net output	60,987	15,796	49,125	19,673
Since Dec. 20:				
Gross output	867,323	576,570	608,715	313,522
Returned	352,173	257,110	183,263	135,568
Net output	515,150	319,460	425,452	177,954
Total outstanding ...	2,467,966	1,899,965	1,550,702	1,097,475

The gain here exhibited is quite noteworthy.

STRUCTURAL MATERIAL FOR NEW DE BEERS POWER HOUSE.—Milliken Brothers, Bowling Green Building, have secured a South African contract calling for the shipment of some 400 tons of structural material, which is intended for the erection of a new power house to be built at the De Beers Consolidated Diamond Mines, Kimberley. The equipment for this plant will include the two 1000-kw Westinghouse-Parsons turbines, direct connected to Westinghouse alternating-current generators of a similar capacity, to which reference has already been made in these columns. Mr. Gardner Williams, the general manager of the De Beers mines, was lately in the United States for the purpose of deciding on further contracts for electrical machinery, etc. These contracts will most likely be placed through Arkell & Douglass, 11 Broadway.

ANTI-PIPE BURSTING COMPANY.—Some time ago a descriptive article appeared in these pages on the ingenious "dome" pneumatic system devised by Mr. Neil Monroe Hopkins—now in charge of electro-chemical studies at the Columbian University, Washington, D. C. Since then the system has been awarded the John Scott Medal by the Franklin Institute, and a company has now been formed at Pittsburg to make and sell the device. It is known as the Anti-Bursting Pipe Company, and has its headquarters in the Standard Building, that city. The device has been subjected to severe experimental and practical tests, and is highly spoken of by such well-known architects and engineers as Bruce Price, John C. Trautwine, Jr., Robert S. Soule, Edward Clark, Ernest Flagg and others. We understand that Professor Hopkins is retained by the new company as its consulting engineer.

PLANTS FOR GOVERNMENT FORTS.—The United States Engineers Corps office has awarded a contract to W. M. Sheehan & Co., whose offices are at 136 Liberty Street, New York City, for two electric lighting and power equipments, which are to be installed in the gun batteries at Fort Hunt on the Potomac. There will be a 50-hp boiler built by P. Delaney & Co., of Newburgh, N. Y.; a 40-hp engine manufactured by the New York Safety Steam Power Company, of Liberty Street, and a 25-kw direct connected dynamo to be furnished by the Crocker-Wheeler Company. One storage battery, manufactured by the Electric Storage Battery Company, of 100 Broadway, is also to be installed at Fort Hunt. The Sheehan Company has also obtained an order for two storage batteries, which will also be furnished by the Electric Storage Battery Company ,for Fort Washington.

HAZARD MANUFACTURING COMPANY, Wilkesbarre, Pa., and 50 Dey Street, New York City, has lately become well-known as manufacturer of insulated wires and cables. It maintains, however, all its old lines, and it is an interesting fact that it has just taken through Mr. G. B. North, New York sales agent, an order for the galvanized steel rigging to be used on Emperor William of Germany's yacht, now building at the yard of the Townsend & Downey Shipbuilding & Repair Company. The riggers are Finn & White, of New York City.

NEW POWER PLANT IN ST. LOUIS.—A huge power plant, to cost $2,000,000, will be built at the foot of O'Fallon Street, St. Louis, Mo., by the Citizens' Electric Light & Power Company. The plans have been completed, and work will begin at once. It is the purpose of the directors to be prepared to compete with rival companies for the World's Fair lighting contract. The contract for the construction of the plant will call for its completion on or before March 1, 1903, under a heavy penalty for delay.

APPARATUS FOR BRAZIL.—Senhor Niccallino Paccarati, Braganca, Sao Paulo, Brazil, writes that he will be glad to receive catalogues of American manufacturers, and prices for a 300-kw alternating-current plant, consisting of two units of 150 kw each. Also for two turbines of 250 hp each for direct connection to the generators. Also for all overhead fittings, switchboard apparatus, transformers, arc and incandescent lamps for the distributing system.

A STILWELL FEED WATER HEATER has been furnished by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, to the Meade Electric Company, of Marion, Ind.

General News.

THE TELEPHONE.

LONE ROCK, ARK.—The Batesville & Winnerva Telephone Company operates 200 miles of toll lines. It has two exchanges of 25 drops capacity each, and has 100 subscribers. It is using the apparatus of the Chicago Telephone Supply Company. President E. A. Farris says that 50 miles of new line is projected, and that the business outlook is very good.

COLORADO SPRINGS, COLO.—The City Council will be asked to grant a franchise to W. C. Robinson and others for a new telephone system here.

KELL, ILL.—A telephone line is being constructed from here to Walnut Hill, via Dix.

COTTAGE GROVE, ILL.—The Cumberland Telephone Company is extending its line west from Cottage Grove.

SHERRARD, ILL.—The Sherrard Telephone Company, capital stock $2,500, has been incorporated by J . C. Vernon, L. R. Trego and H. E. Sudlow.

JERSEYVILLE, ILL.—The Calhoun County Telephone Company has secured a ninety-nine-year franchise from the village board of Hardin to operate a telephone exchange there. The company's lines will have connection with St. Louis.

CLINTON, ILL.—Mr. B. F. Wasson, president of the Farm & City Telephone Company, informs us that he has exchanges at Farmer City, Waynesville, Mansfield, Kenney and Maron, with headquarters at this place. The company has 800 telephones and 800 subscribers.

O'FALLON, ILL.—We are informed by Mr. E. H. Smiley, of Smiley Bros.' Telephone Company, that it is just commencing operations with bright prospects. A 100-drop Kellogg board will be used. An exchange at Lebanon is to be installed under the name of the Lebanon Telephone Company.

GALESBURG, ILL.—Another country telephone line which will connect Galesburg with contiguous territory is being planned and will likely soon be constructed. It is the design to run a trunk line from Rio to Galesburg with connections, including Henderson, where a local board will be put in. Amos Landon, of Rio, is interested in the projected line.

JOLIET, ILL.—Directors of the Interstate Independent Telephone & Telegraph Company, a new $3,000,000 corporation recently organized in New Jersey for the purpose of acquiring and controlling telephone companies, held its first business meeting here recently. Directors were present from New Jersey, Ohio and Illinois. Officers were elected as follows: President, Senator H. H. Evans, Aurora, Ill.; vice-president, Frank Tracey, Springfield, Ohio; secretary and general manager, E. R. Conklin, Joliet; treasurer, A. B. Conklin, Aurora. The principal office will be located in New Jersey, with branch offices in Chicago and Aurora. The company already owns several telephone systems and expects to at once acquire several more.

EVANSVILLE, IND.—The Grandview & Chrisney Telephone Company has been incorporated, with a capital stock of $5,000.

NEW CROYDON, IND.—The State Line Telephone Company has installed Stromberg-Carlson and Ericsson apparatus and has lately built several miles of line. The outlook is good.

INDIANAPOLIS, IND.—Residents of Russellville have incorporated the Indiana Central Telephone Company with $380 capital stock. Directors: John Grimes, William D. Bowers, John Wilson, James Goff and Fletcher Goff.

MURRAY, IA.—A franchise has been granted to the Southern Iowa Telephone Company.

ELLIOTT, IA.—There is talk of extending east to Center Ridge the Farmers' Mutual Telephone line recently built from Henderson.

COUNCIL BLUFFS, IA.—F. M. Wilson, a banker of Templeton, Ia., wants a franchise to establish and maintain a telephone system in Council Bluffs.

OTTUMWA, IA.—C. M. McFatridge, manager of the Moravia Telephone Company, has sold to the Ottumwa Telephone Company of this city the franchise held by that company, giving it the right to erect and maintain a telephone system in Blakesburg.

WEST BRANCH, IA.—The West Branch Telephone Company uses Stromberg-Carlson apparatus. It operates a 100-drop board, 70 of which are installed. There are 190 subscribers, including eight farmers' lines, and the increase is steady, the service being first class.

HILLSBORO, KAN.—The Hillsboro Telephone Company operates a 120-drop board and has 68 subscribers. The outlook is very good.

TOPEKA, KAN.—The Missouri & Kansas Telephone Company will erect a three-story building next spring to be used for the offices and exchange of the company.

WICHITA, KAN.—Mr. Frank L. Brown, of Topeka, Kan., has obtained a franchise here for an independent telephone exchange, the Council refusing to renew the Bell Company's franchise, which has expired. He new has 600 two-year contracts for telephones at $2.50 per month for business and $1.50 for residence. Nearly all of the signers of contracts are the present users of the Bell telephones. Plans and specifications for the entire plant on the basis of 1500 telephones will be completed in about four weeks and the work of construction pushed to completion as rapidly as possible. The new company will be composed of six citizens of Kansas. Mr. Brown has at present the exchanges at Ottawa with 700 telephones and at Garnett with 150.

DAYTON, KY.—The Eureka Telephone Company, of Chicago, has submitted a proposition to the City Council offering to install an independent exchange. The proposition is received with favor.

PORTLAND, ME.—The Dirigo Telephone Company has petitioned for underground conduit rights.

BOSTON, MASS.—At a meeting of the Massachusetts Telephone & Telegraph Company, the old board of directors retired, and the Telephone, Telegraph & Cable Company of America, which controls the Boston & New York Telephone & Telegraph Company, also the Massachusetts Company, elected the following directors: J. T. Morse, of Boston, Oakes Ames, of Boston, Calvin Austin, of Boston; James M. Thomas, of New York; J. E. McDonald, of New York.

TOWN HOUSE, MICH.—The Rollin Telephone Company, capital stock $10,000, has been incorporated.

GARNES, MINN.—The citizens of this place are discussing the question of establishing a telephone system.

DULUTH, MINN.—The People's Telephone Company has been organized and contemplates doing business on the Range.

DULUTH, MINN.—The Duluth Telephone Company is about to begin work on an extension of its lines to Grand Marais, Minn., on the north shore of Lake Superior.

KNOXVILLE, MO.—Another telephone system is talked of at this place.

KANSAS CITY, MO.—The Kansas City Home Telephone Company, capital stock $50,000, has been incorporated by O. C. Snyder, John Enoch, Ed. J. Barber and others.

ST. LOUIS, MO.—The Supreme Court at Jefferson City, Mo., sustains the State franchise tax law and holds that the assessment of Western Union's franchise by the State Board of Equalization is legal and binding.

SEDALIA, MO.—The representatives of twenty independent telephone companies of Central Missouri held a convention in Sedalia Dec. 3, with F. A. Churchill, of St. Louis, as presiding officer. The object of the meeting is to organize an independent line association for mutual protection and to discuss ways and means for establishing a long-distance independent line.

WINSTON, N. C.—The Mutual Telephone Company connects with independent exchanges at several places and operates long-distance lines. Prospects are very bright.

FRANKLIN, N. H.—At a special meeting of the city government the New England Telephone Company was given permission to set poles and extend a line of wires over the Andover road to the boundary line of the latter town.

MORAVIA, N. Y.—The Empire State Telephone Company has recently established a toll line of eight miles to Dresserville and Sempronius. It operates a 50-drop switchboard and has 23 subscribers, with an expected increase.

COOPERSTOWN, N. Y.—The Ives' Telephone Company, capital stock $25,000, has been incorporated. The charter provides for service throughout Delaware and Otsego counties. The company will immediately take over the present Ives' system in Oneonta and rebuild it in a thorough manner.

HOYTVILLE, OHIO.—A telephone exchange is being established here.

GALLIPOLIS, OHIO.—George Titus, who owns the local telephone system, is building a line to Chambersburg.

CUSTAR, OHIO.—The Weston-Grand Rapids Telephone Company is putting in a branch exchange at Custar.

FAIRVIEW, OHIO.—The Union Telephone Company has increased its capital stock from $10,000 to $25,000.

MANSFIELD, OHIO.—The exchange of the Mansfield Telephone Company will be placed in operation at once.

WASHINGTON, OHIO.—The Union Telephone Company has been granted a franchise by the Washington Council.

GRAND RAPIDS, OHIO.—The Central Union Telephone Company is building a new line between Grand Rapids and Weston.

ASHTABULA, OHIO.—The United States Telephone Company is installing a number of lines in the vicinity of Ashtabula.

TOLEDO, OHIO.—Work is being pushed on the new exchange of the Toledo Home Telephone Company. It will be completed by Feb. 1.

BELLEFONTAINE, OHIO.—Directors of the Bellefontaine Telephone Company have decided to build farmers' lines in various directions.

CLEVELAND, OHIO.—The Cleveland Telephone Company has decided to abandon the use of nickel-in-the-slot telephones as a losing venture.

IRONTON, OHIO.—The Lawrence Telephone Company has increased its capital stock from $24,000 to $50,000 and will make improvements.

SPRINGFIELD, OHIO.—The Central Union Telephone Company is installing a new long-distance line switchboard in its Springfield exchange.

PAINESVILLE, OHIO.—The Central Union Telephone Company will overhaul its Painesville exchange. New wires, poles and cables will be put in.

RAVENNA, OHIO.—The Ravenna Home Telephone Company is enjoying excellent business. Twenty-five orders have been taken in the past three weeks.

ADDISON, OHIO.—A telephone company has been organized at Addison. Mr. Frank Vanden is president, Asa Bradbury secretary and T. J. Daniels, treasurer.

MARION, OHIO.—William Callahan, a Toledo engineer, is in Marion preparing plans and specifications for the new plant of the Marion Country Telephone Company.

BUCYRUS, OHIO.—The Central Union Telephone Company has suddenly stopped work on the reconstruction of its lines in this city and all material is being shipped away.

TOLEDO, OHIO.—The Central Union Telephone Company is making extensive improvements to its East Side exchange. Ten sections of new switchboard have been added.

NORTH RIDGEVILLE, OHIO.—The North Ridgeville Telephone Company has increased its capital stock from $2,000 to $10,000, but only $1,000 additional will be issued.

ASHTABULA, OHIO.—The Central Union Telephone Company will install a branch exchange at Kingsville. Heretofore subscribers have been taken care of from the Ashtabula exchange.

XENIA, OHIO.—Since the recent sale of the Little Miami Telephone Company to the Central Union Telephone Company a number of improvements have been made and expenses have been greatly reduced.

GROVE CITY, OHIO.—The City Council has taken steps to compel the Columbus Citizens' Telephone Company to improve its service and give the same rates as charged by the company it succeeded.

COLUMBUS, OHIO.—The Columbus Citizens' Telephone Company is considering the advisability of establishing a sub-exchange, to take care of 3000 subscribers. The company will probably erect the building.

NORWALK, OHIO.—The Norwalk & Huron County Telephone Company has brought suit against the Lake Shore Electric Railway Company to restrain the defendant from stringing wires within specified distances from plaintiff's wires.

RAY, OHIO.—The Vigo & Ray Telephone Company has been incorporated, with a capital stock of $5,000. Incorporators: James Boblett, of Vigo; A. J. Graves and P. W. Graves, of Ray; A. H. Reutinger and Charles Duncan, of Chillicothe.

CANTON, OHIO.—The Stark County Commissioners have notified the Central Union Telephone Company that in the future they will not pay more than $27 per annum for telephone service. This is the figure quoted by the new independent company.

RAVENNA, OHIO.—The Central Union Telephone Company has been permanently enjoined from stringing wires past the residence of a farmer near this place. Decision on the right of poles and lines to occupy the land was reserved until January.

BROOKVILLE, OHIO.—The Brookville Telephone Company, J. C. Snider, president, operates a Swedish-American switchboard of 150 drops, and has 70 subscribers. It has 9 miles of toll line, and projects running others into the country and small towns.

HOWARD, OHIO.—A branch of the Bell Telephone Company has been organized here with the following officers: W. A. Ullery, president; C. M. Chubb, secretary; John Berry, Jr., treasurer; T. B. Shipley, manager. The company will build a farmers' system.

BELLEFONTAINE, OHIO.—The new telephone system is a great convenience. The other day a lady called up the exchange stating that she was going to call on a neighbor. She asked the operator to keep her ear on the baby and if it cried to call her up at No. so and so.

KENTON, OHIO.—The Kenton Construction Company has been organized, with a capital of $50,000. It will build telephone exchanges, and the first will be at Orange, Tex. A similar company was organized at Ada a short time ago, and it has built an exchange at Beaumont, ten miles from Orange, Tex.

LIMA, OHIO.—The Lima Business Men's Association is taking concerted action on the proposal of the Central Union Telephone Company to increase rates or else place eight or ten parties on a single line. Party lines were abolished in Lima some years ago, and the citizens do not want them again.

CINCINNATI, OHIO.—Directors of the City & Suburban Telegraph Association have declared the usual quarterly dividend of 1½ per cent, payable Jan. 2. A resolution was adopted to give each male employe a Christmas turkey and to each of the lady operators a dividend of 6 per cent on their wages.

CINCINNATI, OHIO.—It is stated that the City & Suburban Telephone Association, of Cincinnati, is soliciting five-year contracts with the stipulation that any competition will be met. This is taken to indicate that Bell people believe that the independents will secure contracts to the heretofore exclusive field.

TIFFIN, OHIO.—The Central Union Telephone Company has increased its residence rate from $6 to $12 per year. Before the Tiffin Home Telephone Company commenced business the rate was $24, but it was reduced to $6. The Home Company, which gives $12 residence service is now deluged with Bell business.

PORTSMOUTH, OHIO.—The Central Union Telephone Company has completed the work of enlarging and remodeling its exchange. On Dec. 15 more than 200 farmers in Scioto County were connected and given free service with Harrisonville, Sciotoville, Lucasville, Powelsville, Wheelersburg, Rushtown, Buena Vista, as well as towns on the Kentucky side. Lines will be built to Rarden, Otway and Peebles next spring. Two new toll lines will be built to Cincinnati.

COLUMBUS, OHIO.—J. Warren Smith, section director of the Climate and Crop Bureau of the U. S. Weather Bureau, is sending a circular letter to all telephone exchanges in the State, asking their co-operation in disseminating weather reports. The idea is to telegraph daily weather reports to all exchanges in the State, the information to be given to all subscribers who desire it. Weather bureau reports are already circulated by means of the rural free delivery, but the new scheme would insure a much wider circulation and more prompt service.

CHATTANOOGA, TENN.—It is stated by the persons interested that the grantees of the so-called Wilcox franchise will get their charter at once and proceed to construct a telephone system in the city.

SAN ANGELO, TEX.—A local telephone exchange is being put in at Miles City. Mr. S. M. Farmer is the proprietor.

WICHITA FALLS, TEX.—The Texas Telephone Company, with principal office at Wichita Falls, filed an amendment to its charter increasing its capital stock to $6,000.

NACOGDOCHES, TEX.—The local telephone company, owned by Brandt & Sturdevant, has sold out all its interests to an Ohio capitalist. Mr. J. L. Disener is the new company's manager.

ELECTRIC LIGHT AND POWER.

NEW HAVEN, CONN.—It is announced that the New York, New Haven & Hartford Railroad has given contracts for the installation of an electric light and power plant in the new shops of the company at Readville, Mass. The plant will not only illuminate the shops, but will also operate all the shop machinery.

RICHMOND, IND.—The Wayne Works are spending $25,000 in improvements. A new stack is being erected. A set of 400-hp Sterling boilers, and a 125-hp engine are being installed. The engine will be used to run a dynamo and the whole shop will be lighted.

LAKE PROVIDENCE, LA.—The Board of Aldermen has decided to sell at once $20,000 of bonds for a water works and electric light system.

GRAND RAPIDS, MICH.—A $200,000 stock company has been organized and will shortly incorporate to furnish electric light and power and steam heat throughout the city. The company has purchased the street railway's old power house and will remodel it.

LAKE CRYSTAL, MINN.—Fire, caused by spontaneous combustion, destroyed recently Grail Brothers' flour mill, the electric light plant, water works and telephone system. The total loss is $100,000, one-third insured.

TRENTON, N. J.—The United Gas & Electric Company, capital $4,000,000, has been incorporated here. The incorporators are John D. Fearhake and Frank B. Pierce, of New York, and Edward P. Meeker, of Jersey City.

NEWBURGH, N. Y.—The Moodna Light, Water & Power Company, of Newburgh, capital $20,000, has been incorporated. The directors are H. A. Pressey and H. J. Long, of Washington, and W. J. McKay, of Newburgh.

NEW YORK, N. Y.—The following are the local bids for electric lighting for 1902: Manhattan: Brush Electric Light Company, 40 cents per arc light; United States Electric Light & Power Company, 40 cents each; New York Edison Company, 40 cents each, two lights on each post, 50 cents, incandescent, $22.50 a year. The Bronx: New York Edison Company, 40 cents each, incandescent, $25 per year each; Westchester Lighting Company, 40 cents each, incandescent, $25 per annum. Brooklyn: Flatbush Gas Company, 65 lights in Ocean Parkway, 32 cents per night; Edison Electric Illuminating Company, of Brooklyn, 34 cents for 4350 or more. Queens: New York & Queens Electric Lighting & Power Company, 33 cents for 1,650 or more. Richmond: New York & Staten Island Electric Company, 34 cents for 475 or more.

MIAMISBURG, OHIO.—The Miamisburg Council is considering building a municipal lighting plant.

NEW PHILADELPHIA, OHIO.—Messrs. Beyer and Leiser, owners of the electric plant here, are planning to increase its capacity.

CINCINNATI, OHIO.—The Charleston, W. Va., Water, Gas & Electric Company, capital $1,000,000, has been incorporated at Charleston.

ELYRIA, OHIO.—The Citizens' Gas & Electric Company, of Elyria, has been incorporated by W. F. Carr, C. H. Dale, Steven Hitchcock, F. H. Goff and S. H. Tollis, all of Cleveland.

XENIA, OHIO.—John P. Martin, of Xenia, has been awarded a contract for an electric lighting plant at Tampa, Fla. A company in which he is interested is building traction lines in that city.

CUYAHOGA FALLS, OHIO.—The city lighting plant has been abandoned and the machinery is being removed to the water works plant. The two will be operated under the same roof hereafter.

CINCINNATI, OHIO.—The Cincinnati Gas & Electric Company is preparing to furnish current for the operation by electric power of the Cincinnati & Northwestern Railway, a steam road recently acquired by the Pomeroy-Mandelbaum syndicate of Cleveland.

MASSILLON, OHIO.—It is stated that the recent sale of the Canton-Massillon Electric Railway to the Everett-Moore syndicate did not include the plant of the Massillon Light, Heat & Power Company, the sale of which to the Electric Company of America is probable.

BARBERTON, OHIO.—Some time ago citizens of Barberton voted an issue of $10,000 to build a lighting plant, the plan being to also furnish power to a proposed electric railway. The railway has fallen through and the town is now desirous of making a contract for lighting.

BARBERTON, OHIO.—O. C. Barber is planning to build an immense electric plant to furnish electric light, ice, steam for heating and power, and water, sufficient to supply the needs of the entire town. It will be the aim to make this the only place in the entire town where a boiler or any form of fire will be required.

TOLEDO, OHIO.—The State Board of Public Works has granted the application for a lease of the canal banks, made by George K. Detwiler. The grant will permit Detwiler to string feed wires from his power house on the canal into the center of the city. He will enter into competition for electric lighting with the Toledo Railways & Light Company.

CLEVELAND, OHIO.—The Cleveland Construction Company, which is equipping the Miami and Erie canals for electric propulsion of boats, states that the first section between Cincinnati and Dayton will be in operation April 1. Several engineering difficulties have been encountered, causing delays. Power for the Cincinnati end will be furnished by the Cincinnati Edison Company.

ROCKWOOD, TENN.—The town has voted a bond issue of $6,000 for the purpose of finishing, installing and equipping its electric light plant. The contractors for the Richmond & Petersburg, Va., Electric Railway have completed the road to a point within three miles of Petersburg; the line will probably be completed to this city by Jan. 1. At a meeting of the special lighting committee of the City Council the committee reported favorably on the measure directing the Comptroller to advertise for the building of the municipal electric plant.

DANVILLE, VA.—The Danville Electric Power & Railway Company has been incorporated, with capital stock of $10,000. Geo. F. Anderson and others are interested.

THE ELECTRIC RAILWAY.

SAN FRANCISCO, CALIF.—Articles of incorporation have been filed in Oakland for an opposition ferry system between Oakland and San Francisco to include an electric tunnel railway from Oakland to Goat Island.

FLORENCE, COLO.—The Florence Electric Street Railway Company has been granted a franchise in Canon City.

CHICAGO, ILL.—Nearly 200 trolley cars were burned on the morning of Dec. 15 in a fire which destroyed the barns of the Chicago Union Traction Company at Lincoln and Wrightwood Avenues.

CHICAGO, ILL.—The Chicago Underground Trolley Traction Company, with a capitalization of $2,000,000, has been incorporated at Huron, S. D. The incorporators are D. S. Bergin, A. L. Ringo and Philip Lawrence.

LOUISVILLE, KY.—It is said that early next spring the Jeffersonville, New Albany & Sellersburg Rapid Transit Company will begin the construction of the electric trolley system connecting these three places.

PORTLAND, MAINE.—The Ohio Railway & Light Company, Portland, capital $100,000, has been incorporated by C. D. Booth and H. M. Verrill, Portland, Maine.

FREDERICK, MD.—The promoters of the Washington, Westminster & Gettysburg Electric Railway Company filed a mortgage to the Union Trust Company of Philadelphia, on its property in this State, to secure an issue of $1,850,000 in 5 per cent. gold bonds. The filing of the mortgage is a preliminary step towards the construction of an electric railway from Washington to Gettysburg.

ST. LOUIS, MO.—The Central Belt Railway Company and the Terminal Railway Company of St. Louis are building a fourteen-mile belt line around St. Louis, from the St. Louis and San Francisco terminal on the south to the Burlington & Quincy on the north. The total cost will be over $3,000,000.

EXETER, N. H.—Wallace D. Lovell, of Newton, Mass., has disposed of his electric railway system to the New Hampshire Traction Company, composed of New York and Boston capitalists. The transfer affects the Exeter, Hampton, and Amesbury Railway and its leased lines, the Dover, Somersworth, and Rochester; the Haverhill, Plaistow & Newton, the Seabrook & Hampton Beach, the Amesbury & Hampton, the Haverhill & Plaistow, and the Portsmouth & Exeter railways.

ELIZABETH, N. J.—A certificate of incorporation of another traction company has been filed, the incorporators being Gov. Voorhees, Benjamin A. Vail, of Rahway; Hamilton F. Kean, Julian F. Kean, James Maguire, Frank Bergen of this city, and James B. Cahoon, of New York. The capital stock of the new company is $1,000,000. It is stated that the purpose is to build a street railroad from some point in Elizabeth to a point on the Staten Island Sound, near Boynton Beach. The incorporators elected Mr. Bergen president, James Maguire, treasurer, and Judge Vail secretary.

MONTICELLO, N. Y.—The Monticello, Fallsburgh & White Lake Trolley Company has let the contract for constructing the road to Macatee & Company of Philadelphia.

ALBANY, N. Y.—The People's Traction Company, of New York City, has leased its property and franchises to the Interurban Street Railway Company for a term of 999 years.

BUFFALO, N. Y.—The Lake Shore Traction Company, capital $280,000, has been incorporated. Directors: Arthur C. Wade, A. N. Broadhead, O. L. Becker, W. R. Reynolds, M. R. Stevenson and J. T. Wilson, Jamestown; A. B. Ottaway, Westfield, and Frederick R. Green and Henry D. Kirkover, Jr., Fredonia.

NEW YORK, N. Y.—Mr. E. F. C. Young, president of the North Jersey Street Railway Company, is reported to have said that his company proposes to finish the old tunnel under the Hudson River, between this city and Jersey City, and run its cars through it direct to this city.

ALBANY, N. Y.—The applications of the New York & Brooklyn Union Transportation Company and the New York, Brooklyn & Jersey City Rapid Transit Company to construct and operate railroads through proposed tunnels under the East River from Manhattan to Brooklyn, New York City, has been denied by the State Board of Railroad Commissioners.

BUFFALO, N. Y.—It is stated here that a syndicate of New York, Ohio and Michigan capitalists is now at work securing the right of way for an electric road from Rochester to Buffalo to connect with roads further west now in operation or under construction. The transaction is part of a scheme to extend a trolley line from New York City across New York State into Ohio and ultimately as far as the Mississippi River.

WOOSTER, OHIO.—The Cleveland & Southern Railway has applied for a franchise in Wooster.

DAYTON, OHIO.—The Dayton, Covington & Piqua Traction Company is placing contracts for the erection of its power house at West Milton.

NORWALK, OHIO.—The Norwalk Council has passed an ordinance amending a franchise granted some time ago the Cleveland, Elyria & Western Railway.

LONDON, OHIO.—The Madison County Commissioners have granted a franchise between London and Summerford to the Columbus, London & Springfield Railway.

COLUMBUS, OHIO.—An agreement of consolidation of the Tuscarawas Railway Company and the Tuscarawas Electric Company was filed with the Secretary of State Dec. 4.

AKRON, OHIO.—The city commissioners have approved a franchise asked for by the Northern Ohio Traction Company for a new city line. The company objects to some of the requirements.

PIQUA, OHIO.—The Piqua Council has granted a franchise through town to the Western Ohio Railway Company. This is the last grant required to complete the line from Findlay to Piqua.

FREMONT, OHIO.—The Lake Erie, Bowling Green & Napoleon Railway Company has applied to the Sandusky County Commissioners for a franchise for its line between Pemberville and Woodville.

ALLIANCE, OHIO.—A blanket franchise for 25 years has been granted to the Alliance Electric Railway Company, covering existing lines and proposed extensions. The company is given the right to furnish light and power throughout the city.

COLUMBUS, OHIO.—The Ripley, Georgetown, Hillsborough & Columbus Railway Company, of Georgetown, has been incorporated with $10,000 capital stock, by M. McKeehan, G. Baumbach, A. M. Kantz, W. J. Marshall, O. E. Bare, and J. R. Moore.

HAMILTON, OHIO.—The promoters of the Cincinnati, Richmond & Muncie Railway are quietly endeavoring to secure the stock of the old Four Mile Valley Railroad which was organized about forty years ago, but never built. It has the right of way into Cincinnati.

CINCINNATI, OHIO.—Stockholders of the Cincinnati, Georgetown & Portsmouth Railroad have ratified the action of the directors in authorizing an increase of capital from $400,000 to $1,500,000, also the issue of $1,000,000 5 per cent. bonds, the money to be spent in extending and introducing electricity.

RIPLEY, OHIO.—The Cincinnati, Georgetown & Portsmouth Electric Railway has made a proposition to extend its line through Ripley, if the citizens will subscribe $100,000 worth of bonds; the money to be due when the road is in operation. At a meeting held Dec. 4, over $30,000 was subscribed and it is believed the balance will be raised.

ST. ALBANS, VT.—The St. Albans Street Railway Company has given the contract for the erection and equipment of the new car house and road to the New England Electric Railroad Construction Company.

THE AUTOMOBILE.

A MOTOR HOT-HOUSE has been constructed for Baron Edmund de Rothschild for the transference during the winter of rare plants and flowers from his country estate to his house in Paris.

FOURNIER SEARCHMONT COMPANY.—The Fournier Searchmont Automobile Company, of Saratoga Springs, has been incorporated, with a capital of $2,000,000, $1,000,000 of which is to be 7 per cent cumulative preferred stock, divided into shares of $100 each. The directors are Spencer Trask, John L. Elliott, Acosta Nichols, L. N. Potter and Cecil Baratt, of New York City; G. Blum, of Philadelphia; Benjamin Prince, of Irvington; Chas. J. Peabody, of Englewood, N. J., and Carl J. Smedborg, of Flushing.

NEW INDUSTRIAL COMPANIES.

THE ELECTRIC SPECIALTY COMPANY, Kennett Square, Pa., has been incorporated; capital, $25,000.

THE AUTOMOBILE & CYCLE COMPANY, Kittery, Maine, has been incorporated; capital, $10,000. Incorporators: A. E. Knowlton, Frederick Drowns, Malden, Mass.

THE SHREWSBURY MOTOR WORKS COMPANY, Fair Haven, N. J., has been incorporated; capital, $25,000. Incorporators: Aug. V. Evans, Clarence C. Smock and Warren H. Smock.

THE VEHICLE REPAIR COMPANY OF AMERICA, of New York City, capital $100,000, has been incorporated. Directors: F. C. White, J. H. Burton and L. F. W. Wallace, of New York City.

THE EQUIPMENT MOTOR COMPANY, capital $6,500,000, has been incorporated under New Jersey laws. President Hoadley, of the International Power Company, and A. L. Meyer are said to be interested in the new company.

THE GRINNELL ELECTRIC CABLE CONSTRUCTION AND APPARATUS COMPANY, of New York City, capital $250,000, has been incorporated. Directors: H. B. Grinnell, O. A. Doering and F. E. Thompson, of New York City.

THE CREST MANUFACTURING COMPANY has been incorporated at Cambridgeport, Mass. The business, which is that of manufacturing gasolene motors, automobiles and accessories, has heretofore been conducted under the same name by Messrs. I. H. Davis and E. D. Mullen.

THE UNITED STATES ELECTRIC RAILWAY SUPPLY COMPANY has incorporated in Detroit, Mich., to manufacture trolley stands and other electric railway apparatus. Capital stock, $50,000. Incorporators: Arthur G. and Henry Holland, H. L. Walker, E. L. McConnell, Gordon S. Rutherford and A. E. McKinnon.

THE H. W. JOHNS-MANVILLE COMPANY, of New York City, has been incorporated to manufacture asbestos wares: capital, $3,000,000. Directors: T. E. Wing, H. E. Ballantyne, G. W. Davenport, Robert Dickson, H. M. Wolfe, E. T. Ross, F. W. Knathoff, and H. S. Burroughs, of New York, and W. W. Orr, J. W. Thayer and M. B. Thayer, of Scarsdale, N. Y.

LEGAL.

ELECTRIC VEHICLE ALLEGATIONS.—Two demurrers and an answer have been filed in the New Jersey Court of Chancery in the suits brought by Richard Siegman of New York against the directors of the Electric Storage Battery Company and of the Electric Vehicle Company, on the ground that they participated in various fraudulent stock jobbing transactions and conspiracy to divert from the treasury of the Vehicle company into that of the Battery company certain assets for their personal gain. The demurrers were filed by Corbin & Corbin of Jersey City, representing Martin Maloney and others and

George H. Day and others, the defendants in two of the suits. The answer of the Storage Battery Company was filed by Lindabury, Depue & Foulks of Newark. A sweeping denial is made of the charges in every respect.

TROLLEYMANIA.—A new mental disorder that may hereafter be known as trolleymania was mentioned last week in New York City at the trial of the suit in the Supreme Court by William Hoyt, for many years an employe of the H. B. Claflin Company, against the Metropolitan Street Railway Company for the recovery of $25,000 damages for injuries received in an accident he met with two years ago. According to the testimony, Hoyt was crossing West Broadway at the corner of Worth Street on the evening of March 22, 1899, when he was run down by a trolley car, caught in the fender, and carried a distance of 115 feet before the car was stopped. It was alleged that injuries were received in the accident, and that he suffers from a peculiar delusion, which one of the medical men in the case said might be called trolleymania. Dr. John T. Harrison, of Staten Island, a witness for the plaintiff, testified that ever since the accident Mr. Hoyt had suffered from the delusion that he was being pursued by trolley cars and also that the air was full of the clamor of trolley gongs. A verdict of $10,000 was awarded.

TO REVERT TO CONTROL OF RECEIVERS.—A rather unusual legal tangle resulting from the purchase by the Northern Ohio Traction Company of the property of the Akron Street Railway & Illuminating Company, has been settled by Judge F. J. Wing, of the United States Circuit Court, Cleveland. In May, 1898, a Mrs. De Mangeont was fatally injured by a car in Akron. Her administrator sued for $10,000 and the action was brought against the receivers of the company. Before the case was brought to trial, the road was sold to the Northern Ohio Traction Company, and the receivers applied to the court asking that they be barred from further prosecution, on the ground that they had been discharged from receivership. This claim was set up during the October term of court, and it being a new phase, the attorneys for the plaintiff asked for a continuance to the January term pending further investigation. A motion for the plaintiff was immediately filed in the Circuit Court asking that the discharge of the receivers be vacated for the purpose of having them remain as defendants in the action. Judge Wing granted the order asked for by ordering the Northern Ohio Traction Company, to appear before the Summit County Common Pleas Court as defendant in the case. Failing to do this the court orders that the receivers who were discharged in February, 1900, be reinstated, and that the property now in the hands of the Northern Ohio Traction Company be returned to the control of the receivers until the case is settled.

PERSONAL.

MR. J. L. PUTNAM has recently been elected manager of the Clark Automatic Telephone Switchboard Company, Providence, R. I.

MR. ANDREW CARNEGIE, who was himself at one time a telegraph operator, is said to be entertaining some plans for the benefit of veteran and decayed members of the craft.

MR. LEMUEL BANNISTER, well known from his prominent connection with Westinghouse Electric interests abroad, has, it is stated by cable, resigned from such management, etc.

MR. T. A. EDISON has been reported seriously ill, but "there is life in the old dog" and lots of work for many years to come. The Edisons are a hardy race, live long, and are stayers. It is a pity Mr. Edison has always had a low opinion of holidays, but he keeps Christmas.

COL. ROBERT ANDREWS.—Directors of the Safety Car-Heating & Lighting Company have elected Col. Robert Andrews president of the company, succeeding the late Arthur W. Soper. Col. Andrews was formerly vice-president. The vacancy in the board was filled by the election of A. G. Soper.

MR. C. L. EDGAR, president of the Edison Electric Illuminating Company of Boston, was in New York City last week and spoke with pleasure of the satisfactory close of the consolidation of the lighting interests in that city. He took occasion to make a careful inspection of the new Waterside station of the New York Edison Company.

MR. HENRY C. PAYNE, of Milwaukee, Wis., will become Postmaster-General in President Roosevelt's cabinet. He is a Republican leader in the West. He is an old telegraph operator, and is heavily interested in telephone and electric railway enterprises in Wisconsin. There are rumors that the Government proposes to try taking over the telegraphs.

MR. FRANCIS H. SHEPARD, who has recently been abroad, has just returned. Mr. Shepard has resigned his position with the Sprague Electric Company, where he has acted as assistant to Mr. Frank J. Sprague in his engineering work, and has accepted a very responsible position with an English syndicate to carry on important work in heavy electric traction in that country. Mr. Shepard will return to England in February.

MR. C. C. ADAMS.—It is stated from Philadelphia that C. C. Adams has been agreed upon by the directors of the American District Telegraph Company as president of that corporation, to succeed the late Edward J. Matthews. Mr. Adams is now vice-president and general manager of the company, and his selection for the presidency is in line of promotion and recognition of long service. He is the local manager of the Postal Telegraph Company.

MR. U. N. BETHELL, the general manager of the New York Telephone Company, who lately took charge of Bell telephone work in Washington, etc., has now been elected president of the Chesapeake & Potomac Telephone Company, in the place of Judge Wilson, recently deceased, and a member of the board of directors. It is understood that the headquarters will not be removed to either New York or Baltimore, but will remain in Washington, Mr. Bethell making trips every week to that city.

MR. CORNELIUS VANDERBILT lectured before the Society of Arts at Boston on Dec. 12, in the Institute of Technology, his subject being locomotive boilers. Before he finished he referred to the fact that his boilers are adapted to the use of oil as fuel. Five of his engines are now in use on the Central and several on the Baltimore & Ohio, Union Pacific, Southern Pacific, and other roads. Electricity for trunk lines he considered out of the question, at least for the present, although for local traffic it is all right.

MR. WILLIAM B. CLAFFLIN has been appointed architect to the New York & New Jersey Telephone Company. This company expects to soon erect three or four handsome buildings in Brooklyn for use, in part, by its exchanges, and their design and construction will be in Mr. Claflin's charge. Although a Philadelphian he has spent his active professional life since graduation from the Massachusetts Institute of Technology in New York City, having been connected with the firms of McKim, Mead & White and Carrère & Hastings. In his new duties Mr. Claflin will be closely associated with Mr. Bancroft Gherardi, Jr., chief engineer of the telephone company.

MR. F. S. WILLIAMSON, a member of the firm of Charles Henry Davis & Company, is selected, it is said, as consulting engineer to the Department of Public Works under the Low regime. He is an Englishman. During his engineering experience he has furnished many reports as expert, among them, upon changing the Vera Cruz tramways from horse to electricity, and opened a bridge over the Hudson at Peekskill for Sir Douglas Fox, the English engineer. The city has called him in as expert in several instances, notably upon the failure of the gas-tank on the East Side three years ago. He was also engaged on the Boston Rapid Transit Subways. He has been a member of the American Society of Civil Engineers for fifteen years, and is also a member of the British Institute of Civil Engineers, and the Canadian Society of Civil Engineers.

EDUCATIONAL.

TELEPHONY AT PURDUE UNIVERSITY.—It is announced that Purdue University is to have a new department. It will be a course in telephonic engineering, and will embrace all the scientific theoretical and practical phases of this great and growing branch of electrical work. The new course will begin next February, and the junior and senior members of the school of electrical engineering will be required to devote about one-half of their time to the subject. The course will be complete in every detail and will embrace all the necessary training for the sending out of a skilled workman in this field. The new department was added only after the most serious and careful consideration by the trustees and faculty of Purdue, and was designed to meet a growing demand for competent telephonic engineers. Professor J. C. Kelsey, a graduate of the University of Nebraska, and a man of broad experience and learning, will have charge of the new department. Mr. Kelsey comes highly recommended by telephone men from all over the United States. He is thirty years of age, and is now with the Duluth, Minn., Telephone Company. Mr. Kelsey was formerly with the Western Electric Company, of Chicago, and is considered a most competent and thoroughly up-to-date teacher of telephony. Prof. W. C. Goldsborough of the electrical department, deserves great credit for the efforts that he has put forth in getting the new course arranged and instituted at Purdue. It is also greatly to the credit of the Sterling Electric Company, of Lafayette, Ind., the well known telephone manufacturers, that it has co-operated in securing this recognition of the importance of telephonic work.

Trade Notes.

THE LITTLE GEM ROSETTES, manufactured by Pass & Seymour, Incorporated, Solvay, N. Y., are the subject of a little artistically illustrated pamphlet just issued by the company. These rosettes are made for all classes of wiring.

THE SMITH & HEMENWAY COMPANY, 296 Broadway, New York City, one of the youngest and foremost hardware firms, is the publisher of a unique catalogue known as the Green Book of Hardware Specialties, which will be sent free to any one on application.

"SOLID" TELEPHONE RECEIVER.—Wm. J. Murdock & Company, Chelsea, Mass., makers of the "solid" telephone receiver are calling attention to the good points of this instrument in a neat booklet just issued. This receiver was described and illustrated in our issue of Dec. 7.

HYDRAULIC VALVES.—The Watson-Stillman Company, 204 East Forty-third Street, New York, has in preparation its sectional catalogue No. 63, relating to high pressure hydraulic valves and fittings. A copy may be obtained by any one interested in this line, by applying to the company, stating the line of business, position, etc.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, has recently received an order from the De Beers Consolidated Mining Compony, Limited, of Kimberly, South Africa, for a very large Cross oil filter to be used in its new power house. Only American machinery will be employed in this plant, and the Burt Company considers this a strong endorsement of its filter.

VICTOR COOLING TOWERS.—In a pamphlet issued by the Victor Cooling Tower Company, St. Louis, Mo., is described and illustrated the Victor water cooling tower for condensing engines. Among the illustrations are several half-tone views of actual installations of these towers. The Laufketter-Bendit Mercantile Engineering Company, 810 Olive Street, St. Louis, is the general sales agent.

ELECTRICAL LEAD REDUCTION.—This interesting application of electric power at Niagara Falls is described in the pamphlet of the Electrical Lead Reduction Company, whose principal offices are in Philadelphia, and works at Niagara Falls. This process of converting lead ore into various lead compounds is claimed to be the cheapest, quickest and most efficient. The works at Niagara Falls are shown in a double page illustration.

RECORDING PRESSURE AND VACUUM GAUGES.—The Bristol Company, Waterbury, Conn., recently issued a revised catalogue of its recording pressure and vacuum gauges. The list covers all ranges of pressure adapted to all possible uses. The company will be pleased to mail copies of this catalogue on application. It is now preparing new editions of its catalogues of recording instruments for temperature and electricity.

THE INTERNATIONAL TELEPHONE MANUFACTURING COMPANY, Chicago, is rapidly progressing in the making of the special tools, dies and machinery necessary for the manufacture of the many new features in its various

systems for central energy and generator call, public and private telephone plants. From present indications, it is claimed, it will have some of its equipment on the market within the next few months.

ALTERNATING ENCLOSED ARC LAMPS.—The Dayton Fan & Motor Company, Dayton, Ohio, has issued a leaflet calling attention to the main points of the alternating enclosed arc lamps on the Belden system, which are manufactured by it.

STERLING LAMPS.—Symmetrical distribution from incandescent lamps is the subject of a pamphlet just issued by the Sterling Electrical Manufacturing Company, Warren, Ohio. The article, which is reprinted from these columns, refers to the Sterling special incandescent lamp. All interested in lighting should read this pamphlet, which deals with one of the latest developments in incandescent lamp manufacture.

LUNDELL MOTORS.—The applications of Lundell motors of the various types for the driving of machines of different kinds are well shown in Bulletin No. 207, just issued by the Sprague Electric Company, New York. The advantages of operating machines with Lundell motors are briefly enumerated. The Bulletin is almost wholly taken up, however, with illustrations showing a large variety of applications of these well-known motors.

RAILWAY STORAGE BATTERY PLANTS.—Bulletin No. 67 of the Electric Storage Battery Company, Philadelphia, Pa., consists of a description of the storage battery equipment of the Brooklyn Heights Railway Company, written by Franklin E. Morse, superintendent of power, Brooklyn Heights Railway Company, and reprinted from the *Street Railway Journal*. The paper is illustrated by curves, and a feeder diagram of the Brighton Beach line.

HOT WATER PACKING.—After exhaustive tests covering a period of two years the H. W. Johns Manufacturing Company has placed on the market a packing to be used on plungers and rods of pumps, delivering water at a temperature above 180 degrees F. In every test which has been made, this packing has lasted six times as long as any other packing subjected to the same conditions. The Kearsarge asbesto-metallic packings, produced by this company, are meeting with ever widening favor.

"THE NIGHTS OF OTHER DAYS" is the title of a pamphlet containing some "glimmerings of the past and the brilliancy of the present, by Packard," just issued by the New York & Ohio Company, Warren, Ohio. The story, which is brief and lively, starts from the early dawn of light and rapidly leads us down to the Packard incandescent lamp. There is a ring and a melody to it that will arrest the attention of the lamp man long enough to read it through and enjoy a good laugh. Then he will be in the humor to order some Packard lamps.

COLGATE WIRING COMPUTER.—Mr. A. E. Colgate, 56 Pine Street, New York City, has sent us a sample of his neat and handy wiring computer, to be carried in the vest pocket. It is 6 inches long, 1 inch wide and ¼ inch thick, and is of the slide variety. It is strong, with wooden case, ivory slide, and mica cap, bound with brass. The owner can quickly figure out sizes for given loss, carrying capacity, distances, etc. On the back is a table of the safe carrying capacities for interior wiring which must not be exceeded from No. 16 to No. 0000, with the amperes for each.

FEED-WATER PURIFIERS.—The Hoppes Manufacturing Company, Springfield, Ohio, has just issued a catalogue describing and illustrating its line steam feed-water purifier, standard exhaust steam feed-water heater, new cast-iron feed-water heater, the method of connecting feed-water heaters by means of the company's new induction chamber, its steam separator and oil eliminator, and its new cast iron exhaust head. The illustrations are artistically executed, many of them showing views of actual installations, heaters in transit, etc. The catalogue will interest every one concerned in steam generation.

HUBBARD, HALL & COMPANY, of Cincinnati, Ohio, is a live, up-to-date business house. They are shipping goods in larger quantities than ever and are receiving inquiries from all sections. They are agents for the Adams-Bagnall Electric Company's arc lamps for inside and outside lighting, also for the Columbia Incandescent Lamp Company, and are having no trouble in renewing their contracts which were in force last year, and are taking on new ones frequently. They are just issuing their new calendars for this year, which are accompanied by a letter printed on Cincinnati souvenir paper, and make an attractive design and idea.

TELEPHONE APPARATUS.—In a circular addressed to "The Discriminating Public" the Kellogg Switchboard & Supply Company, Chicago, Ill., makes some common-sense remarks on the selection and purchase of telephone apparatus, and it makes a special introductory offer to introduce the Kellogg receiver and transmitter. Telephone outfits and switchboards of the express, the Bell and the combination central energy and magneto types are illustrated, brief descriptive notes accompanying the illustrations. The last page of the circular contains a view of the Kellogg Company's factory and a history of its successful career.

WARREN ALTERNATORS.—The Warren Electric Manufacturing Company, Sandusky, Ohio, recently brought out a fine catalogue, of quarto size, giving seven full-page illustrations of its apparatus of the various styles, and one page showing detail views of the Warren transformer. The illustrations are depended upon to tell their own story, as they are unaccompanied by any descriptive matter. They are so clearly executed, however, that they need no description in words. The cover is of dark slate color, with a panel of silver bearing the words, "Warren Alternator," printed in black letters. It is a very attractive and artistic production.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, is sending out a very neat circular on something that is entirely new, and should prove invaluable to contractors and construction men in general. This circular illustrates a new unit type of combined switch and enclosed fuse carrier. By carrying a small stock of these, first-class panel boards of any number of circuits can be built on short notice from these fuse carriers. This would certainly seem to be exactly what every contractor has been looking for, thus saving the delay of having to order boards from the manufacturer. This is one of the most useful and practical devices that has been gotten out for some time.

THE ELECTRICAL MATERIAL COMPANY, Baltimore, Md., has just issued an attractive catalogue of 212 pages covering the electrical field quite fully. It is a very comprehensive production and the claim of the company that it deals in "all things electrical" seems to be justified, since the list includes everything in the way of electrical apparatus and supplies. It is seldom that in a catalogue of this character such articles as dynamos, vitrified conduits, etc., are listed, but in this catalogue these are found, with many other things that rarely enter regular catalogues. The Electrical Material Company carries a stock of supplies in all electrical branches—telephony, telegraphy, electric light, electric railway, transmission, for the household, etc. The catalogue has a neat embossed cover, and is profusely illustrated, the text and illustrations being printed in green.

"THE LIVING AGE."—During the fifty-eight years of its existence this sterling weekly magazine has steadily maintained its high standard. It is a thoroughly satisfactory compilation of the most valuable literature of the day, and as such is unrivalled. As periodicals of all sorts continue to multiply, this magazine continues to increase in value; and it has become quite indispensable to the American reader. By its aid he can, with an economy of time, labor, and money otherwise impracticable, keep well abreast with the literary and scientific progress of Europe in a very satisfactory manner. It is the most comprehensive of magazines, and its prospectus is well worth the attention of all who are selecting their reading matter for the new year. To all new subscribers for 1902, the publishers offer free the Seventeen Weekly Issues for the four months September to December, 1901, inclusive, until the edition is exhausted. *The Living Age* Company, Boston, is the publisher.

A MAMMOTH CATALOGUE.—We doubt if a larger trade catalogue is published than that of Manning, Maxwell & Moore, 85 Liberty Street, New York, the well-known dealers in machinery and supplies. The 1902 catalogue, which is just out, contains a total of 1056 pages, including 7538 illustrations, the pages measuring 12½x9½ inches. The list includes everything imaginable in the way of supplies for railways, steamships, machinists, factories and mills, also electrical supplies. The index alone takes up 38 pages, three columns to the page, and at the back there are several pages of useful tables. It used to be the fashion, in referring to a large and varied business, to say that it dealt in everything, from a needle to an anchor. Here is a case where this idea finds a concrete example, and while we do not find needles in the list we do find anchors and other things of iron and steel much heavier. There are many articles quite as small as needles, however, such as fine drills, etc., hence the application practically holds good. The range of subjects represented by the illustrations is a very wide one indeed, and everything in the mechanical line seems to be included. The volume is substantially bound in heavy boards, and will rightfully claim first place among trade catalogue libraries.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED DEC. 10, 1901.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, Times Bldg., New York.]

688,008. TOLL COLLECTING MACHINE FOR TELEPHONES; W. A. Foss, Cleveland, Ohio. App. filed March 25, 1901. (See Current News and Notes.)

688,282. ELECTRIC SWITCH; C. A. Bergstrom, New York, N. Y. App. filed July 21, 1900. Details.

688,291. ELECTRIC STORAGE BATTERY OR ACCUMULATOR; Wm. J. Buckley, Chicago, Ill. App. filed Sept. 1, 1900. A high-tension battery in which a partition of ebonite or similar material fits into dovetailed grooves in a receptacle. Each side of the partition has ribs fastened in the form of grooves in which the active element is inserted. The elements consist of a series of thin lead strips which are formed into a metallic frame, and between which the active material is included, the completed plates being slid into the grooves in the partition. To complete the connection between the cells, the plates on either side of the same partition are connected at the top.

688,293. TELEPHONY; Geo. A. Cardwell, New York, N. Y. App. filed Nov. 16, 1899, renewed May 10, 1901. (See page 1026.)

688,317. WINDING FOR ELECTRIC MACHINES; Benjamin G. Lamme, Pittsburg, Pa. App. filed April 17, 1900. Coils are wound into final form before insertion into the core slots, except as to one end; these latter ends being free, the coil is enabled to be inserted in the slot when the free ends are connected up.

688,318. WINDING FOR ELECTRICAL MACHINES; Benjamin G. Lamme, Pittsburg, Pa. App. filed April 30, 1901. Bars of different lengths are used which are in such groups that the bars of each group shall have a minimum difference of potential. The ends of the bars of each group are spread apart, thus providing sufficient space for attaching the end connectors, and at the same time insuring a sufficient degree of separation for connectors to provide proper ventilation.

688,337. MEANS FOR ELECTRICALLY CONNECTING RAILWAY CARS; E. B. W. Reichel, Berlin, Germany. App. filed Feb. 19, 1901. A coupling consisting of two pivoted levers, one on each car, and one resting by its weight upon the top of the other.

688,340. DIRECT-CURRENT DYNAMO-ELECTRIC MACHINE; August Roth, of Berlin, Germany. App. filed May 19, 1900. An auxiliary magnet is employed, being placed in the pole gap, and at an angle longitudinally with a plane through the axis of the armature; the magnet windings are in series with the armature. The object of the arrangement is to overcome the deleterious effects of armature reaction.

688,346. TROLLEY POLE FOR ELECTRIC CARS; P. Scholtes, Mount Oliver, Pa. App. filed Sept. 16, 1901. A locking device holding the wire upon the wheel until it is released by pulling the rope.

688,359. CIRCUIT BREAKING DEVICE FOR ELECTRICAL CIRCUITS; Lewis B. Stillwell, of Niagara Falls, N. Y. App. filed June 12, 1900. A time-element and non-reversible circuit breaker, A clock-work retards the opening of the circuit, upon excessive current flow in normal direction; upon excessive flow in reverse direction, a small motor causes a locking arm to stop the clockwork before the circuit is broken.

688,364. ELECTRIC FURNACE; E. R. Taylor, Penn Yan, N. Y. App. filed Dec. 21, 1899, renewed April 18, 1901. (See page 1028.)

688,382. MECHANISM FOR TRANSMITTING POWER TO DYNAMO MACHINES; Otto Bohn, Oberschonweide, Germany. App. filed Aug. 22, 1901. Frictional transmitting devices are interposed between the driving and driven parts, which through the intermediary of a spring produces a certain amount of frictional pressure; an electromagnet is provided to counteract this friction pressure. The excitation is controlled by the terminal voltage of the machine driven.

688,393.—ELECTRIC FURNACE; Ramon Chavarria Contardo, Sevres, France. App. filed May 22, 1901. The furnace is mounted on trunnions and means are provided for oscillating the same.

688,394. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Creveling, New York, N. Y. App. filed Dec. 7, 1900. The air pressure in the braking system of a train is used as a part of the regulating apparatus of a train-lighting generator driven from the axle.

688,401. ELECTRICAL APPARATUS; J. E. Everett, Indianapolis, Ind. App. filed Feb. 21, 1901. The armature conductors of a dynamo or motor are connected with a false commutator and the real commutator is held against the false commutator so that corresponding segments will be in contact. This provides for renewing the real commutator without disconnecting the armature wires.

688,403. ELECTRIC BATTERY; G. W. Frazier, Allegheny, Pa. App. filed Feb. 14, 1901. A dry cell is provided with a plugged-up hole in the bottom, through which to introduce moisture and electrolyte, after the cell has become apparently exhausted.

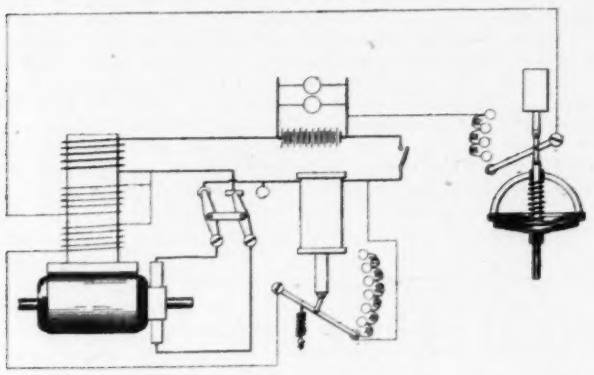
688,404. SMOKE DETECTOR; O. Freyman and C. Tolman, Brooklyn, N. Y. App. filed April 1, 1901. (See Current News and Notes.)

688,423. COMMUTATOR BRUSH HOLDER; H. J. W. Lloyd, Des Moines, Ia. App. filed Feb. 11, 1901. Details.

688,433. TELEPHONE RECEIVER; F. J. Orr, Holland, N. Y. App. filed Jan. 12, 1901. (See page 1026.)

688,452. TELEPHONE EXCHANGE SYSTEM; H. G. Webster, Chicago, Ill. App. filed Dec. 31, 1900. (See page 1026.)

688,456. ELECTRO-MECHANICAL AUTOMATIC STREET RAILWAY SWITCH; Walter J. Bell, Los Angeles, Calif. App. filed July 2, 1901. An arrangement whereby the motorman can switch a car without alighting from it or stopping it. A contact is made on the side of a trolley pole, which



688,394.—System of Electrical Distribution.

closes a circuit supplying power to operate the track switch; mechanical means operated by the car resets the switch.

688,458. STEREOSCOPIC X-RAY APPARATUS; E. W. Caldwell, New York, N. Y. App. filed Sept. 27, 1901. (See Current News and Notes.)

688,480. ELECTRIC LAMP AND SOCKET THEREFOR; D. D. Nugent, Harrison, N. J. App. filed Jan. 4, 1901. The bulb is formed with a bead which is grasped by spring fingers projecting from the socket, the only metallic portion of the base being a disk across the end of the neck.

688,486. TROLLEY CONTACT POLE; E. B. Robertson, Philadelphia, Pa. App. filed July 12, 1901. The trolley pole is provided near its center with a hinged joint and a supplemental spring is inserted between the two parts to cause the wheel to more surely hug the wire.

688,494. THERMO-ELECTRODYNAMIC TRANSFORMER; Philip K. Stern, New York, N. Y. App. filed Feb. 15, 1901. The hollow interiors of the pole piece of a revolving field serve as the steam cylinders of a single-acting engine of the Brotherhood type.

688,506. ELECTRICAL CONTROLLER ATTACHMENT; G. L. Fairbrother, Thompsonville, Conn. App. filed April 19, 1901. A plate adapted to be attached to the top of the controller to lock the controller handle at each point until it is unlocked by the motorman.

688,509. TROLLEY; F. W. Garrett, Johnstown, Pa. App. filed Dec. 1, 1899. To afford good contact between the wheel and harp a brush is secured to the wheel and bears against the harp.

688,554. CIRCUIT MAKING AND BREAKING DEVICE; J. F. Skirrow, East Orange, N. J. App. filed Feb. 4, 1901. A relay or sounder in which the armature is mounted on spring strips instead of a hinge, thus permitting the current to pass directly through the armature instead of through a separate contact strip attached thereto.

688,568. TROLLEY; M. J. Wilson, Painesville, Pa. App. filed Aug. 12, 1901. Details.

688,572. ELECTRIC RAILWAY; F. M. Ashley, Brooklyn, N. Y. App filed Feb. 26, 1898. The switch magnet for delivering current from the feeder to the section is mounted on a carriage and drawn through a conduit by a magnet carried by the car.

688,575. ELECTRIC LAMP; Henry Baggett, Blackheath, Eng. App. filed Sept. 13, 1899. Improvements in the braking arrangement of cord lamps. A drag device is provided with a vertically movable gravity support adapted to be raised and lowered by a movement of the carbon-feeding mechanism so as to lower the drag device against the periphery of the pulley and to raise it therefrom.

688,583. ELECTRIC KNIFE SWITCH; W. F. Bossert, Utica, N. Y. App. filed May 20, 1901. Details.

688,614. REGULATOR; Augustine R. Everest, Lynn, Mass. App. filed May 4, 1899. Two moving contacts operate to vary the turns of the secondary winding from both its ends. The working circuit, instead of being connected across the supply mains, has one of its terminals connected to the one of the supply mains to which the primary of the working transformer is connected, and the other to an intermediate point in the primary.

688,629. TROLLEY WHEEL GUARD; E. W. Gailey, Allegheny, Pa. App. filed May 13, 1901. Fingers projecting radially from disks on each side of the trolley wheel serve as guards to hold the wire in place. The fingers will yield in case they are struck, and afterwards will return to their normal position.

688,649. ELECTRIC ARC LAMP; Chas. H. Kayser, Orange, N. J. App. filed March 5, 1901. A simplified construction of a lamp for use in connection with kinetoscopes, stereopticons and similar projecting apparatus, the lamp being equally adapted for use with alternating and direct currents.

688,650. APPARATUS FOR MEASURING ELECTRICAL ENERGY; R. Kennedy, Leeds, Eng. App. filed Feb. 21, 1901. (See Current News and Notes.)

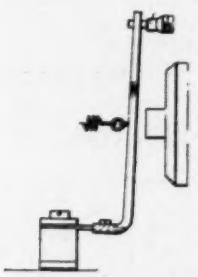
688,673. TELEPHONE SYSTEM; Chas. H. North, Cleveland, Ohio. App. filed May 17, 1900. (See page 1026.)

688,676. TELEPHONE; W. S. Paca, Baltimore, Md. App. filed Jan. 20, 1897. (See page 1026.)

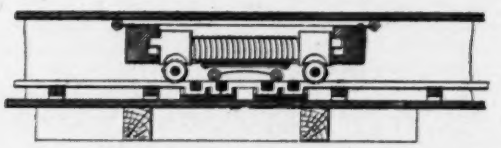
688,724. ELECTRIC SIGNALING DEVICE FOR RAILWAYS; W. A. Farrel, Wellsville, N. Y. App. filed April 1, 1901. Means for sounding an alarm in a cab of a locomotive in case a switch ahead is open.

688,738. ELECTRIC SWITCH; J. Jones and J. Jones, Jr., New York, N. Y. App. filed Nov. 6, 1900. Details.

688,749. STORAGE BATTERY TRAY OR CASE; Elmer A. Sperry, Cleveland, Ohio. App. filed Sept. 13, 1899. The case of each cell is of thin metal constituting one of the electrodes; a tray or receptable for cases has a number of stiff separating partitions which are arranged in contact with the



688,554.—Circuit-Making and Breaking Device.



688,572.—Electric Railway.

side walls of the adjacent cases, insulating material being placed between the several individual cases.

688,781. CUT-OUT FOR CRANES; G. A. Hassel, McKeesport, Pa. App. filed July 27, 1901. An automatic circuit opener operating in case the attendant does not stop the motor at the proper time.

688,788. PRIMARY BATTERY; H. I. Lurye, New York, N. Y. App. filed Jan. 30, 1901. A battery comprising an outer jar and an inner receptacle open at top and bottom and having a lower straining portion and an outwardly-extended flange made to form a bottom or support in the outer jar, said outer jar being made to form a reservoir for crystals or the like and said inner receptacle being made to contain elements within said receptacle.

688,797. ELECTRIC RAILWAY SWITCH; Philip Siegel, New York. App. filed June 13, 1901. The track switchpoint is worked by an electro-magnet which is controlled by a switch on the car.

688,805. ALTERNATING CURRENT MOTOR; E. Wilson, County of Kent, Eng. App. filed Jan. 17, 1893. (See Current News and Notes.)